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# Rock Products

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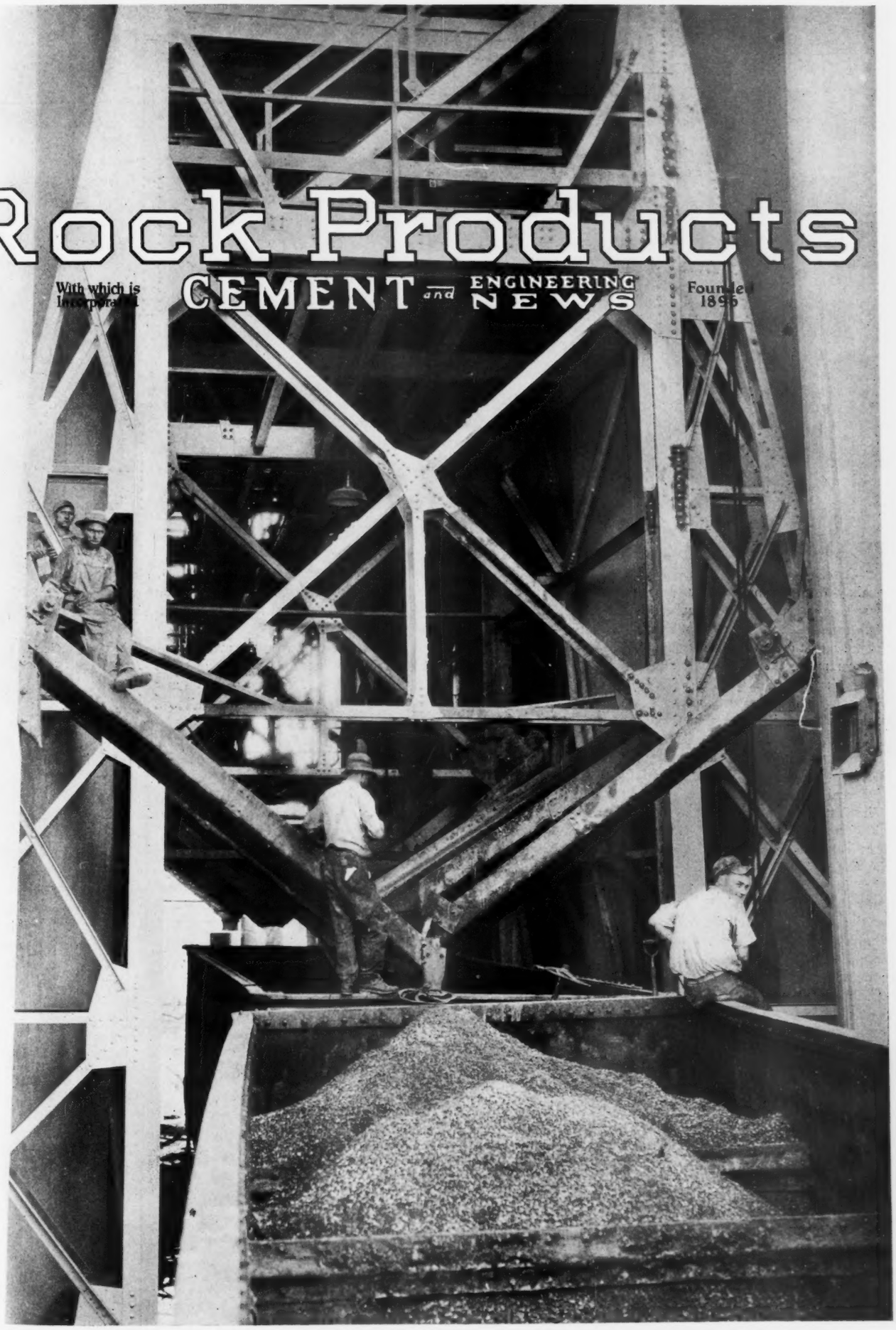


*Eight spouts loading material from four bins into railroad cars, Arrow Sand and Gravel Co., Columbus, Ohio*

*Looking over the deposit at Columbus, only one mile away from the heart of the city*

# Applied Gravel-Plant Engineering

## Stephen Stepanian of the Arrow Sand and Gravel Co., Columbus, Ohio, Applies Broad Knowledge and Experience to Special Problems

THE new plant of the Arrow Sand and Gravel Co. of Columbus, Ohio, was mainly designed by the vice-president and manager of the company, Stephen Stepanian, although he says he received many important suggestions from the other officers of the company, all of whom are familiar with the rock products industries. Mr. Stepanian was an engineer before he went into the sand and gravel business, in the employ of the Jeffrey Manufacturing Co., and fully conversant with what was needed to make a successful sand and gravel plant. The first plant he built for the Arrow company is still considered one of the best in Ohio. The new plant therefore represents not only the work of a trained engineer but of one who has been constantly thinking of how he could improve on previous designs, so that he could put up the best plant possible for the conditions under which it would have to operate.

Standard machines and equipment are used throughout, but in the way in which the machines have been placed and in the flow of the material from one unit to another, there are rather striking novelties. At the same time, the plant is one that cannot be slavishly copied, for it is adapted to unusual deposit and marketing conditions.

It is situated one mile from the center of Columbus, on Furnace street, not far from the Mound street bridge. It has direct connection with the Hocking Valley railroad and switching limits of six other railroads, but being so near the city, a great part of its production is shipped by truck. Hence it had to be designed as much for truck as for railroad shipment, something of a problem, for, as Fred Cornuelle pointed out in his paper at the Cincinnati sand and gravel convention, trucking plants and railroad plants must have altogether different features, and it is hard to combine the two in a single design. But Mr. Stepanian has succeeded in doing this very successfully. And the market is such in Columbus and vicinity that many more products must be made than in some other localities, which introduced another unusual feature. The layout of the plant is such that the diversity of products required may be secured in the simplest way.

*The Mound St. plant of the Arrow Sand and Gravel Co., Columbus, Ohio*

An unusually large crushing capacity had to be provided. One of the pictures shows a cut through one of the Arrow deposits, which are largely made up of large pebbles, or cobbles, with smaller pebbles and sand filled in between them. It is estimated that 60% of the Arrow production is of material that is wholly crushed, and that 80% of the pieces show some angularity. At least 70% of the material in the ground is gravel, or cobbles and buolders. There is from 25 to 50 ft. of this material, bottomed on fine sand and covered with about 8 ft. of overburden. The heavy overburden is perhaps the reason why this deposit, lying so near the city of Columbus, was not exploited before.

A Monighan dragline with the latest type of

walking device is used to dig the material, handling a 6-yd. Page bucket at the end of a 100-ft. boom. It has a 240-hp. Fairbanks-Morse Diesel engine for a power plant. This machine does both the stripping and the digging of the material. At present it is working in ground that it stripped last winter, while the plant was being built, but as soon as this is exhausted it is expected that it will do the necessary stripping while there are no cars to be loaded, sidecasting the dirt into the worked out area.

The dragline loads into standard gage, hopper-bottom 36-ton railway cars, of the self-cleaning type. Three of these make a

*Illustrating the coarseness of the gravel in the deposit*

train which is pulled into the plant by a 35-ton Porter steam locomotive of the saddle back type. The track is about a half mile long at present, but the distance will be lessened as the deposit is worked.

The cars dump into a concrete track hopper, 18x24 ft., with sides sloping about 45

*Looking down the skipway on the track hopper*

deg. At the bottom of the hopper are two quadrant-type gates, worked by compressed air, through which the material runs into the skips which are hoisted to the top of the plant. Curtis air hoists raise and lower the gates and the air is supplied by a Gardener double vertical compressor connected by a "Tex-rope" drive to a 10-hp. Allis-Chalmers motor. This pumps into a 4x5-ft. tank, and the motor is automatically shut off as soon as the required pressure in the tank is obtained.

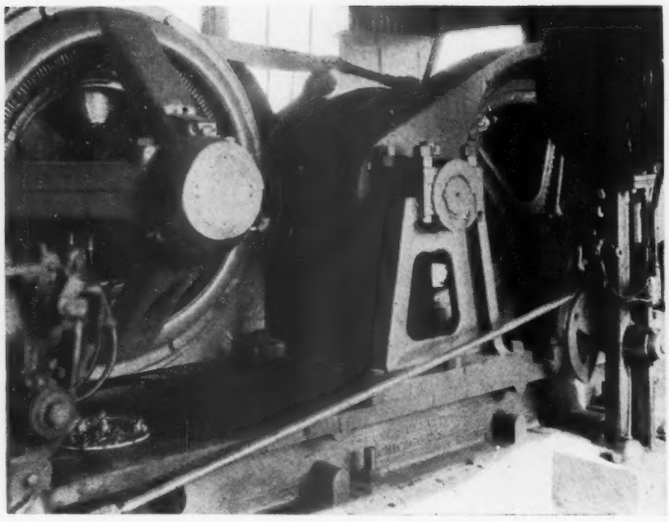
Each skip has a capacity for six tons of gravel and a ton of water, about the load that is regularly hoisted. They are pulled up a skipway supported by two structural steel trusses and a single bent near the center. The inclination is 45 deg., and the vertical distance is 100 ft. from the ground at the foot of the plant to the platform where the skips are dumped. It is about 120 ft. to the top of the skipway, where the sheaves are placed.

The skips are pulled up by a Thomas single drum hoist, with a 50-in. drum and a 200-hp. motor. The rope is carried from a skip at the bottom to a number of turns around the drum and then to the skip at the top. With this arrangement the weight of the empty skip coming down balances the weight of the skip going up, so that no more power is used than that necessary to raise the material in the skip. The hoisting speed is 350 ft. per minute.

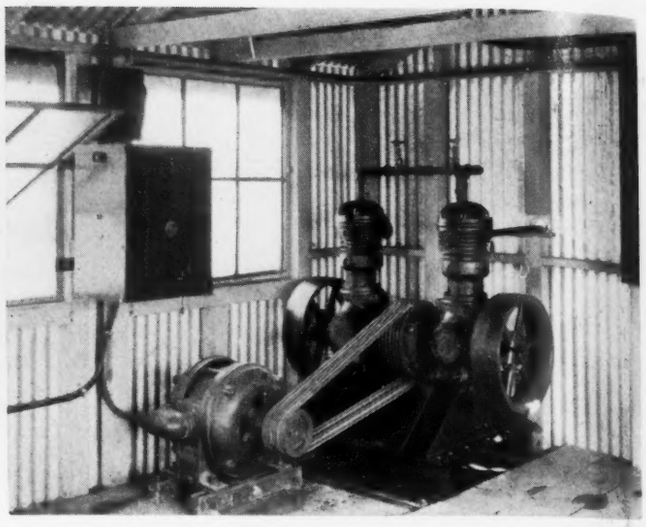
The man who runs the hoist (with only two levers to handle) also fills the skips through the air-controlled gates. Another man, on the track above the hopper, keeps the rails clean and occasionally punches the material down in the hopper.

*Dragline loading cars in the field*

*Locomotive hauling cars in from dragline*



*Single-drum electric hoist for raising skips*

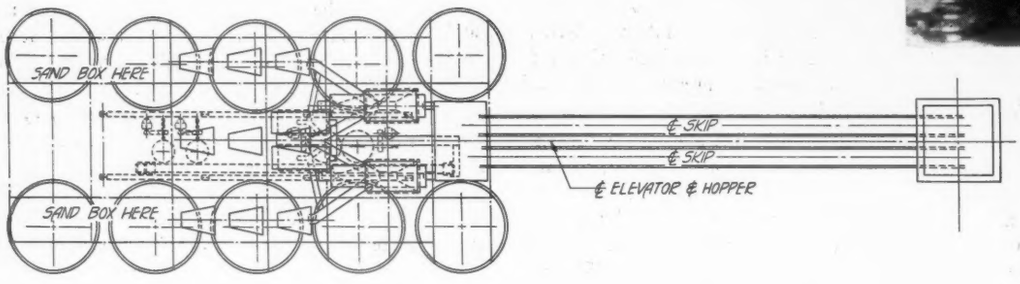


*Automatic compressor and drive furnishing air for the gates*

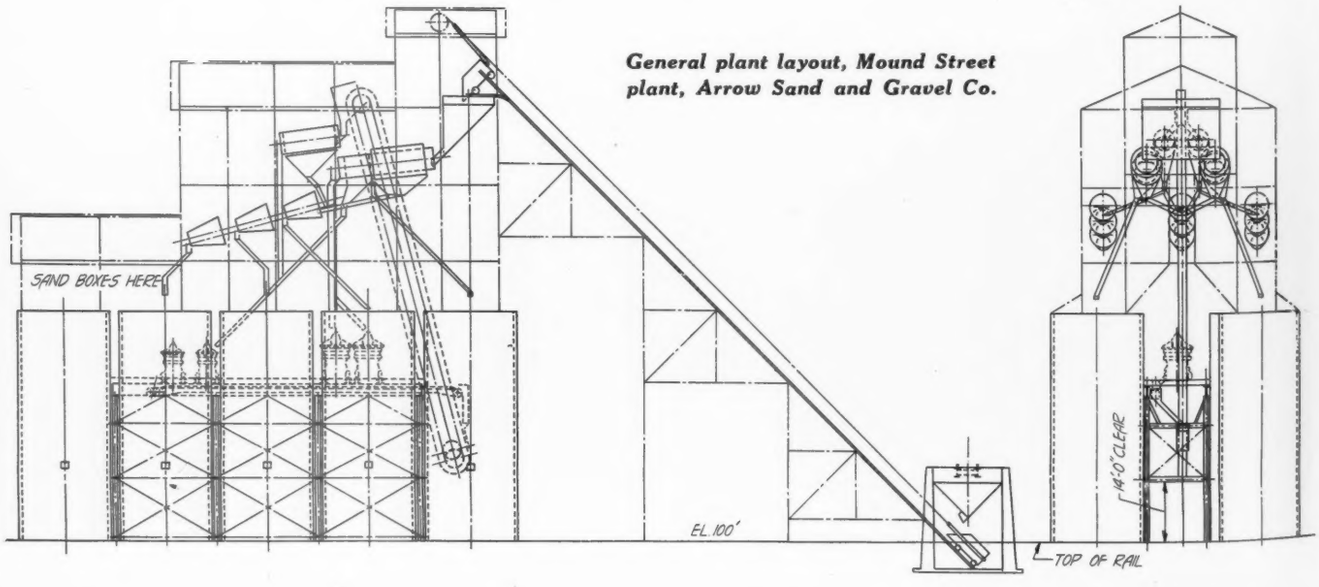
Mr. Stepanian, whose specialty with the Jeffrey company was conveying and elevating machinery, was asked why he preferred a hoist and skips to the usual belt conveyor. He answered that the nature of the material was the main reason for preferring skips. It is full of large pieces, which would have required a wide and heavy conveyor, and the maintenance costs would have been heavy. There is considerable water to be handled which would have meant special arrangements for drainage and a sloppy condition for the belt. Another advantage of skips is added capacity for feeding the plant is easily provided. The hoist has sufficient power, and the skipway is strong enough for heavier loads so only larger skips need to be installed.

At the top of the skipway a safety device has been provided for over-running of the skip car. The wheels of the skip being hoisted strikes a "hatchway switch" by which the current is thrown off and the brakes applied to the hoist. The load flows out into a

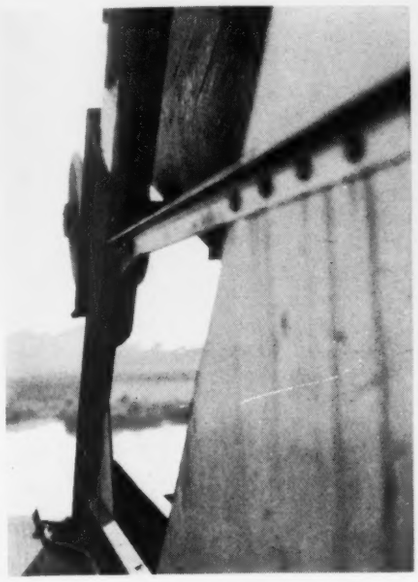
*The 6-yd. bucket on the dragline*




*General plant layout, Mound Street plant, Arrow Sand and Gravel Co.*



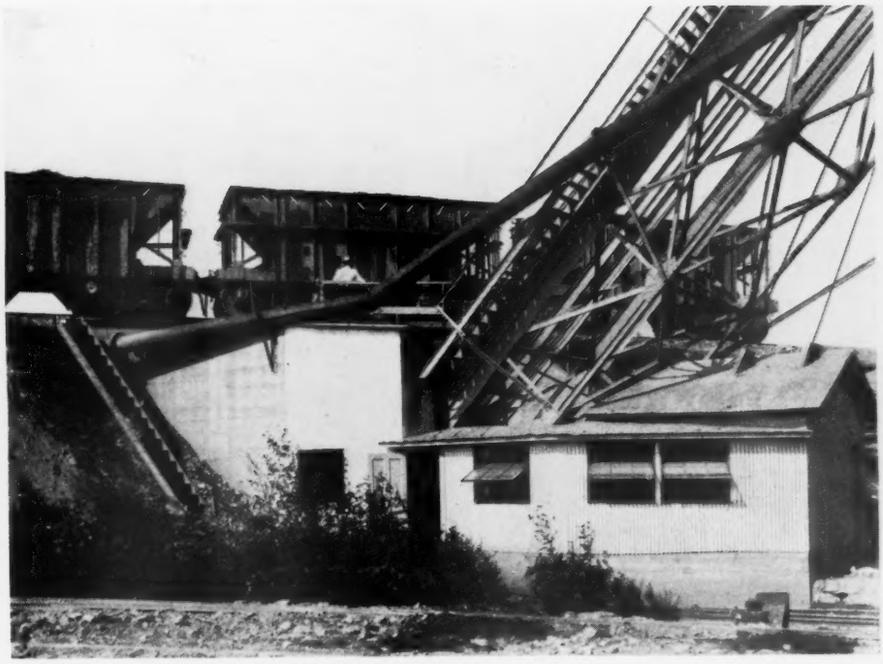
steel bin, which was equipped with gates operated by hand when the plant was visited for this description, but which are soon to be operated by compressed air. From these gates the material flows into two Galland-Henning rollerless rotary screens, of the type designed by Hugo W. Weimer. These have



***The "hatchway switch" at top of skipway by which the current is thrown off and the hoist braked***

a large babbitt ring for a bearing at the end where the material enters and are 20 ft. long and 60 in. in diameter. The main section is covered with ½-in. plates punched with 2½-in. square holes set on the diagonal. There is a sand jacket for about half the length of the screen and this has 5/16-in. holes. Each screen is driven by a 25-hp. motor through a Jones speed reducer.

A novelty in the design of this plant is that these screens, which are the primary screens of the plant, are not placed on the upper floor, but on the second floor down. The upper floor is occupied by the screens



***Hoist house and track hopper at foot of skipway***

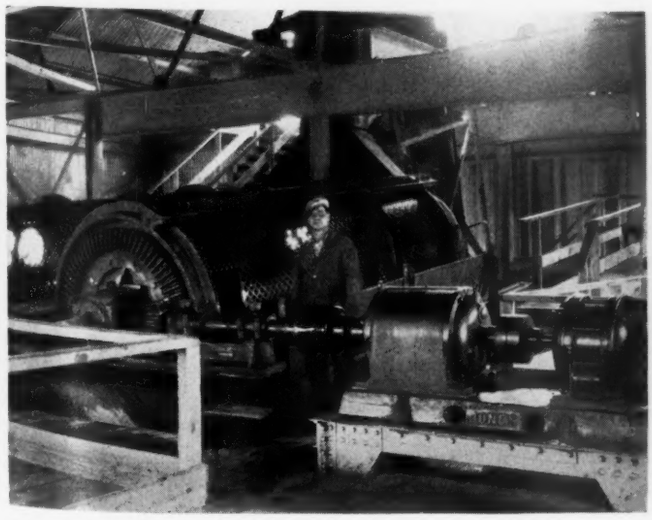
which receive the discharge of the crushers, and the advantages of this will be explained later.

Water is added at the primary screens, two 4-in. pipes being taken off the 12-in. pipe rising vertically from the top to the bottom of the plant. These 4-in. pipes passing through the discharge ends of the screens are perforated to make a strong washing spray. The most of the water and the sand pass through the holes in the sand jacket and go to the Dull sizing screens. The oversize goes to the crushers and the intermediate size may be sent either to the sizing screens or to the crushers whenever material smaller than 2½-in. is wanted.

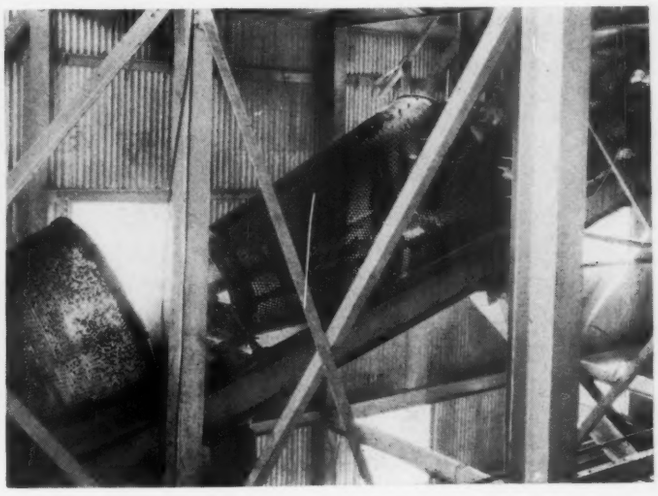
The sizing screens are of the Dull conical (Link-Belt) pattern, in two lines of three each. They are set one line at either side of the building which brings them almost over the centers of the silos into which the products fall. The drive of each line is a 15-hp. motor, through a Link-Belt silent chain and a gear and pinion and a bevel gear. Each screen has a pipe from which there issues a strong stream of water to play on the material at the point where it is turned over and over in the screen.

The first screen in each line is perforated with 1-in., the second with ⅝-in. and the third with 5/16-in. holes, all square. Each screen is 8 ft. long, 72 in. in diameter at the large end and 36 in. in diameter at the small end.

At the ends of the two lines of Dull screens are the sand recovery boxes, of Jeffrey make. These have steel tanks, or boxes, about 50 ft. long, 3 ft. wide and 4 ft. deep over all. Each contains a drag chain with manganese steel flights, 30 in.



***Scalping screens and speed reducer drive***



***One line of sizing screens at side of building***

wide, to drag out the settled sand. The feed is admitted about half way down the side and the overflow is at the extreme end, opposite the sand discharge end. There are sprays to wash the sand off the chain and flights on the upper side, so as to keep the bearings as free from grit as possible. The sand is discharged without any free moisture, containing only the moisture that clings to the surface.

Space is left, and all arrangements have been made with supporting steel structure, to install a third line of Dull screens and a sand box in the center of the plant whenever a greater capacity is wanted.

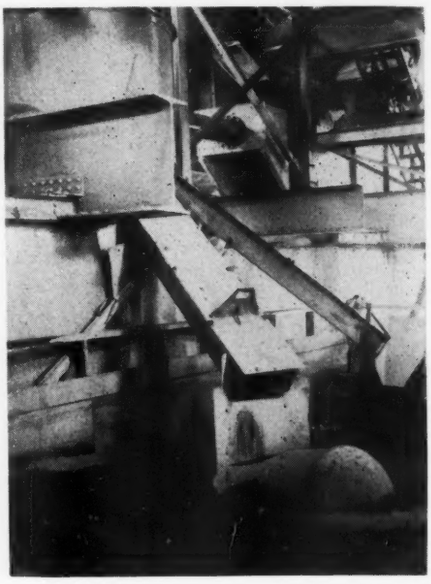
Going back now to the primary screens, the oversize from these (plus 2½-in.) and usually the intermediate size (minus 2½-in. and plus 5/16-in.) goes to the crusher floor. The crushing department of this plant is decidedly novel, for the crushers instead of being set on the usual concrete foundations are set on a floor carried on a steel structure 32 ft. above grade line. The supporting columns are "H" type, built up of plates and angles, and are 12x18 in. in section. There are 10 of these, each with a tapered brace on the outside, and diagonal bracing between the braces and the columns, and also between the columns, keeps everything rigid. The cross members holding the floor are built up 30-in. I-beams on which the crushers rest, and they are connected with 18-in. I-beams running the other way.

The floor on which the crushers stand is of ¼-in. checkered steel plate, and this has been made an integral part of the design to provide stiffening.

There is a surprisingly small amount of vibration in this floor and frame work when the crushers are running. Some of the photographs illustrating the plant were taken from the end of this floor, with the crushers in motion, and they show no vibration, although vibration could be felt in other parts of the building.

Headroom was saved by placing this floor between the silos, which support the building and the remainder of the machinery, and about 20 ft. below their tops. In this position there is just room for the necessary braces to clear a railroad car with the space required for loading.

There are four crushers on this floor, two 10-in. gyratories and two 6-in. gyratories all



***Round steel tanks and steel chutes above crushers***

in one line. All are of Allis-Chalmers make, and all are of the Superior McCully fine reduction type. All have "Tex-rope" drives, the 10-in. crushers being connected to 100-hp. motors and the 6-in. to 50-hp. motors.

The discharge of all the crushers goes through holes in the floor to a 24-in. belt conveyor 72-ft. centers delivering to an elevator of the "super-capacity" type, of Jeffrey make, but designed by Mr. Stepanian. The buckets are 18x24-in. on top and about 24-in. deep. They are close connected on a driving chain and have flanged wheels which run on rails. A guard rail on both sides keeps the wheels from running off. The speed of this elevator is 75 ft. per minute.

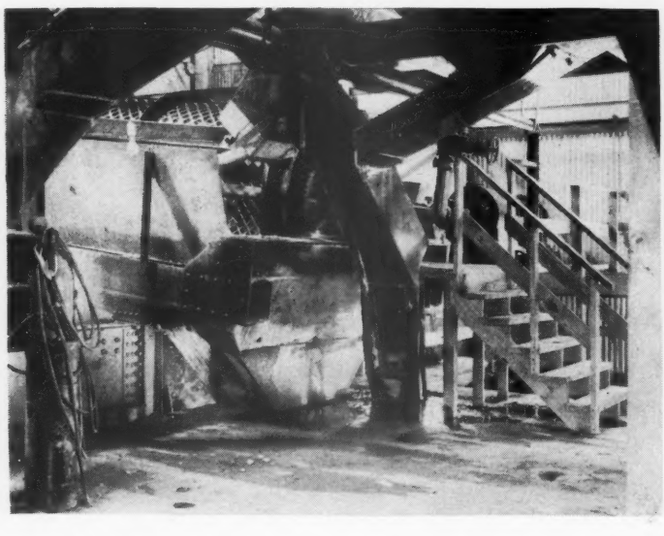
Elevator and belt conveyor form a single unit by which the crusher discharges are conveyed and elevated to the crusher screens at the top of the plant. Since one is of no use without the other, they are driven by one 50-hp. motor, which is placed at the top of the elevator and connected to the head driving sprocket by a train of gears and pinions.

A sprocket on the bottom pulley of the elevator carries a chain driving a sprocket at the head pulley of the belt conveyor. The speed of the elevator is slower than that of the belt, so a "step up" gear and pinion follows the sprocket.

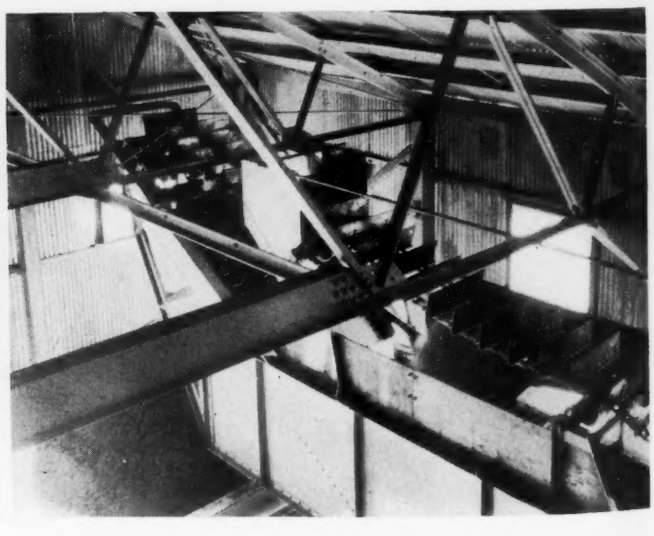
The elevator is 80 ft. from center to center and it lifts the crushed material to the two screens which are on the topmost floor of the plant, above the primary screens. These are of Galland-Henning make, 16 ft. long and 60 in. in diameter. The screening surface is 12 ft. long, in two parts, the first having 1-in. square holes and the second 1½-in. square holes. The holes in both sections are punched through steel plate and set on the diagonal, as in the primary screens. Each screen is driven by a 20-hp. motor through a Jones speed reducer.

These screens are provided with washing sprays like those of the primary screen, but the whole screen, or either section, may be run dry. This is of advantage in producing material for road maintenance, in which the dust is wanted. The screen products may be sent to bins or to the sizing screens previously mentioned, or the oversize may be sent back for finer crushing.

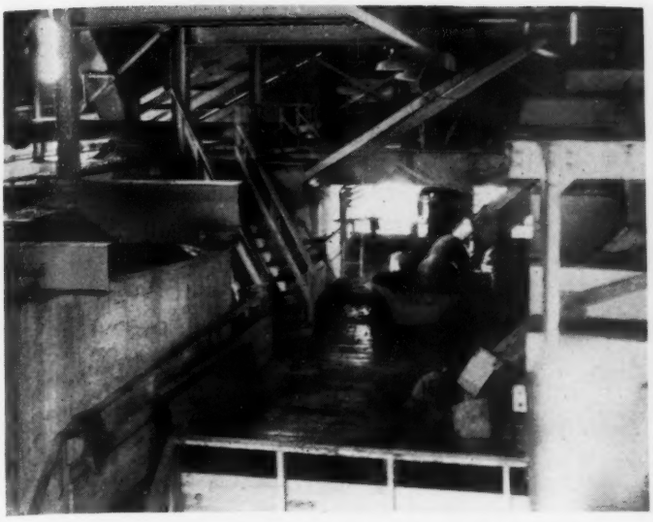
The position of these screens above the primary screens permits the products to be thrown in many ways; material from the crushers may be made into dry crushed stone, washed crushed stone or half washed and half unwashed, and also, as is the usual practice, thrown in with the uncrushed gravel of the same sizes. Thus, in a very simple way, the plant can make a variety



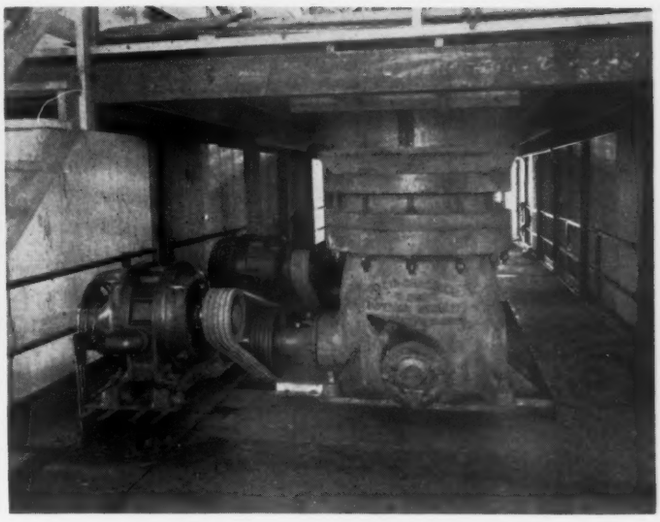
***End of the primary screen. The chutes are from the secondary screens above***



***Sand recovery box showing the drag chain with manganese steel flights***



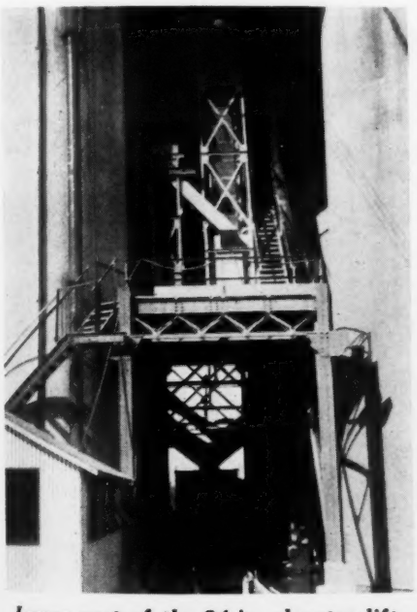
*Looking down on the crusher feeding floor*



*One of the crushers and its short center rope drive*

of products without changing any of the equipment or doing any more than changing the gates in some of the chutes. And at no time is any part of the plant idle.

The finished products fall into 10 concrete silos, each 50 ft. high and 20 ft. inside diameter. These were erected by the McDonald Engineering Co. Each will hold



*Lower part of the 24-in. elevator lifting the discharge of the upper screens*

about 600 tons of material which can be run out into trucks or railroad cars, the remainder making a permanent bin floor. Outside storage is later to be provided.

Each bin is provided with two quadrant gates and spouts on the inside and two on the outside. The inside spouts are for loading cars on the track running between the rows of silos. Railroad cars are also loaded from the spouts on one side of the plant and trucks from the spouts on the other side.

The application of power in this plant is somewhat novel, as so many "Tex-rope" drives are used. They are used with various sizes of motors, from the small one which drives the compressor to the 100-hp. motors driving the 10-in. gyratory crushers. Speed reducers, all of Jones make, are more used than in the ordinary gravel plant. There are two on the primary screens and two on the screens for the crushed material and two more on the drives of the sand box drag chains.

All the motors of the plant are Allis-Chalmers with Timken bearings except the two driving the pumps which are slip-ring type. The switchboard and other electrical accessories are of General Electric make. The switchboard is arranged so that a man starting up the plant has only to throw in the switches from left to right to have the plant units start in the proper order to receive the feed, the sand boxes first, then the sizing screens, then the other screens and finally the elevator and conveyor and the crushers.

The water supply is from two 8-in. Weinman pumps, which are placed under the floor of the building housing the air compressor. These are each driven by 100-hp. motors. The discharge of both pumps goes into a 12-in. steel pipe from which take-offs run to the screens and sand boxes.

The building which houses all the washing, sizing and crushing machinery is placed on top of the silos which are the plant bins,

*Silos on truck loading side of the plant*

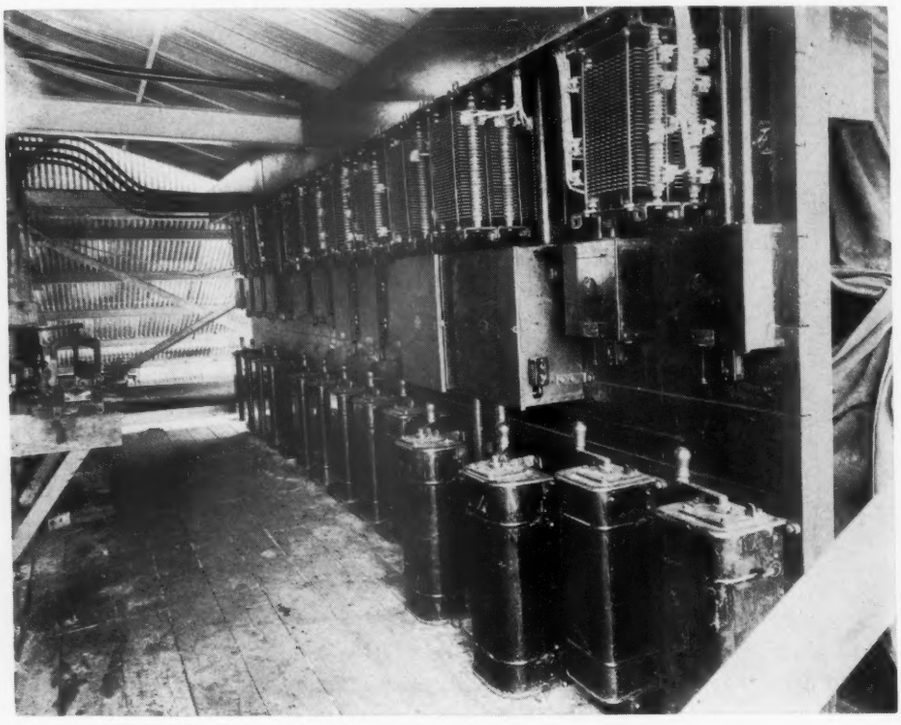
*Car-loading side of the silos*

and it is of steel frame, covered with "Armco" steel siding. All the chutes and the small hoppers above the crushers are of steel. In fact the only wood used in construction is in the floors and stairways. The building is exceptionally free from vibration, when the height and the kind of construction are considered. Even the running up and down of the skips does not shake it much.

The location of the plant had to be carefully considered in order to provide for both truck and rail delivery—it had to provide entrances for the railroad and a short road from the highway. The situation chosen gave this advantage and also an ample turning space where trucks could make the turn

after loading or wait in line to be loaded.

The design of the plant was also greatly influenced by the need to provide for truck and railroad loading. By placing all the machinery on top of the silos, space was left on three sides, and the two tracks and space for the trucks left clear. The decision to mount the heavy crushers on a floor supported by bridgework of such height and span took some courage to make, as it is practically unprecedented. Mr. Stepanian consulted with other engineers and examined many plans of industrial plants of one kind and another before he was satisfied such a novel installation would be practical. It is this feature of the plant, combined with the location chosen which adapts it for trucking as well as railroad deliveries, without going to the expense of setting up a separate loading point connecting by a long conveyor.



***The main switchboard from which all machines are started***

Conveying and elevating has been purposely kept to the minimum in this plant. Wherever material is crushed, there must always be at least one elevator to lift the crushed discharge to a screen inclosed circuit. Crushing plants which have tried to omit this elevation have almost always added it later. So the belt conveyors and bucket elevator combination described may be accepted as the least amount of such machinery that could be employed.

Throughout the plant a gravity flow of material has been secured by raising it high enough at the start and by setting the screen for the crushed material at a sufficient height. Since skips are used to raise the material the matter of a few feet more of elevation is of no moment, the cost for power and attendance being about the same.

The new plant was designed to have an average capacity for 3000 tons of material a day. It had been running only a month at the time this article was written, but it had already shown it was capable of making its estimated output. The company has another plant, which was described in Rock Products for April 22, 1922, which has a capacity of 2000 tons a day of finished material. The new plant is so arranged that only additions of sizing screens and sand boxes, for which space has been left, are necessary to bring the output up to 5000 tons per day.

The office of the Arrow Sand and Gravel Co. is in the Hartman building, in Columbus. H. J. Kaufman is president; Stephen Stepanian is vice-president and general manager; W. H. Hoagland is treasurer, Robert H. Pausch is secretary, and John W. Kaufman is director. Most of these names will be familiar to the readers of Rock Products from their connection with the Marble Cliffs Quarry Co. J. L. Marsters is plant manager and R. M. Bowen is the superintendent and constructing engineer of the new Arrow plant; he was formerly assistant superintendent of the Marble Cliffs plant.

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## Absorption of Freights Again!

THE problem of the absorption of freight rates, discussed in so much detail in the editorial columns of Rock Products, June 25, 1927, is ever cropping up. A practice that is so hard to justify among producers is naturally little understood by users. The user cannot understand why he should not benefit from proximity to the plant he buys from, while the producer of course knows that he can't absorb freight rates if he does not get a much better price for his material in his immediately locality. Thus the "freight absorber" not only incurs the enmity of his faraway competitors by invading their markets, but becomes "a robber" to his best customers near home. Here is a good example, quoted verbatim from the *State* of Columbia, S. C.:

"C. E. Jones of Batesburg, chairman of the South Carolina highway commission, said last night that the 'cement' investigating committee, which has been looking into the rock and sand situation, has found that sand is costing 40 cents a ton too much in the construction of Capital Highway district roads. 'Of course,' Mr. Jones said, 'it is the contractor who has to pay this price, but in the long run the price is paid by the department, which must pay the contractor for building the roads.'

"Mr. Jones said that one of the things brought to the attention of the committee was that the prices charged by the sand dealers were greatly divergent according to where the sand was used. He says that on the road going to Augusta in the capital district it is convenient for the contractor to use sand from a certain nearby pit and that the price charged at the pit is $1.10 a ton. The same sand is shipped to Florence at 40 cents a ton, f.o.b. the pit.

"Sand delivered at Batesburg costs $1.15. With a reduction of 50 cents a ton for freight, the sand company gets 65 cents a ton for sand delivered at Batesburg, he said, and the dealer gets 65 cents a ton for sand in all other points in Saluda and Lexington county, or 25 cents more than for that used at Florence.

" 'We are further informed,' continued Mr. Jones, 'that sand is being shipped from these same pits for state highway work in Tennessee at 25 cents a ton, f.o.b. cars. This places an excess charge on South Caroline requirements in Lexington and Saluda counties of 40 cents a ton. As approximately 1500 tons of sand are used in each mile of construction, it appears that the contractor is paying an excess of about $600 a mile for sand.'

"Mr. Jones said that the situation in other counties would be investigated also and that the prices on stone and cement would also be considered. The above statement is speaking specifically, he said, only for Lexington and Saluda counties.

" 'The committee is interested only in more and better roads with available revenue,' he said. 'We are looking out for the interests of the taxpayer. It is necessary that we look out for the contractor,' he continued, 'because in order to give low bids the contractor must first be assured of getting his material at the best possible price.'

"The committee to inquire into the rock, sand and cement situation will hold another meeting next week, it was announced."

# Quarrying Bauxite in Arkansas

## American Bauxite Co. Has Immense Workings Near Benton and a Large Crushing and Drying Plant

THE mineral bauxite may be said to lie on the border line between the metallic ores and the rock products raw materials. It is the principal ore of aluminum and yet a great part of the world's production is converted into abrasives, chemicals, and, in late years, into cement. For bauxite is the component that gives the alumina content to the quick-hardening cements made in France and other European countries and called high-alumina cements, and the cement which is called by the trade name of "Lumnite" in the United States.

Bauxite is produced on a commercial scale in France, Italy and Austria in Europe and in Brazil and Guiana in South America. In the United States there has been a greater or lesser production in several states. But the largest and best known deposits are in Arkansas, near Benton, and about equally distant from Hot Springs and Little Rock. There are three producing companies in that locality, but the largest, and probably the largest producer of bauxite in the world, is the American Bauxite Co. It has immense workings and a very large and complete crushing and drying plant in which the rock is prepared for shipment. It is also one of the model large scale industrial operations of the country, both from an engineering and a sociological point of view.

The extent of the workings of this company may be judged from the fact that 16 miles of narrow gage railway are required to connect the different working places with the crushing and drying plant.

### *Deposit*

The bauxite found here is the alteration product of a syenite which is somewhat local in its character. The original rock is of a light gray color, with black specks, rather coarsely grained and with the crystals in star patterns. It is largely composed of feldspar. Bauxite, the alteration product, does not resemble it at all in appearance. It is a darkish red in color, from the oxidation of the iron content, and has a "bird's-eye" structure resembling that of oolitic limestone but of a much coarser grain. For this reason it is generally called oolitic bauxite. But not all the bauxite shows this oolitic structure.

The mineral lies in beds which vary in thickness and in composition. Twelve feet is considered to be a fair workable thickness, but a thickness of 16 ft. to 18 ft. is not an unusual thing in this deposit. These beds were at one time the surface of the country and they were eroded then into low hills and shallow valleys. Afterward they were covered with a deposit (of clay with some sand and gravel) which is of Tertiary origin. This new surface has also been eroded into low hills and shallow valleys, but the old and the new surfaces bear no relation to one another. In fact the valleys of the present surface run in a different direction from the valleys of the bauxite beds, and this makes the overburden unusually heavy in certain places.

Just as in working limestone deposits, the depth of the overburden is the principal factor that decides whether the deposit shall be worked by open quarrying or by underground methods. The limit, of course, would vary in every situation, but here it is set at 35 ft. Wherever the overburden is greater underground methods are considered cheaper, unless there is some unusual reason for continuing with open quarrying.

### *Silica Content Governs Uses*

Whether bauxite may be used for certain purposes or not depends upon its silica content, and to a lesser extent upon its iron content. For the principal use, to make alu-

***General view of the plant and bauxite deposits of the American Bauxite Co.***

minum, a silica content of 7% is permitted; for some other purposes as high as 12% silica is allowed. For making high-alumina cement those who have such a business in mind have been seeking a bauxite with less than 2% silica. It is found in these Arkansas deposits, but to produce it would be expensive, as it would have to be carefully selected.

On account of the low silica content permissible the ground is prospected and sampled with a thoroughness not found elsewhere in the rock products field, and stripping is carried to where nothing but a clean surface of bauxite remains. Prospecting is done by Keystone well drills. Core drills have been tried, but have been found not so good for this work, as it seems impossible to obtain a continuous core. So samples are taken from the sludge of the well drill. At first holes are put down 300 ft. apart each way. Next, if the ground appears to be of sufficient value to open workings, it is drilled 50 ft. and sometimes 25 ft. each way. From this drilling a map is made which shows the depth and contents of the deposit where it is being worked. Finally all the sludge from the drill holes that are put down when the deposit is to be blasted are saved and analyzed as a check on the mapping. The whole matter of prospecting and determining the grade which is to be worked is in charge of the engineering department. An assistant to the chief engineer is almost constantly at the face, either in the open workings or underground. The foremen in charge of the men who load cars are told in just what grade of rock they are working and as each car goes out a red tag is attached to it which bears the chemical analysis of the contents of the car. A tolerance of only 0.5% is permitted in silica content, and if cars have to be sent in which pass this tolerance they are marked with a white tag, showing they are not to be included without a special order.

### *Stripping*

Stripping is done by contract. The contractor uses an Erie shovel and takes off the heaviest of the overburden in one or two lifts, loads it into trucks and hauls it away. Then wheeled scrapers are used to get down as close to the rock as possible, after which the ground is scarified and the dirt wheeled away. Shovels and picks have to be used to clean out channels. There is a deposit showing like a film over some parts and this is almost pure silica, so it is removed by picking and shoveling. The last part of the process is to sweep the stripped surface with brooms of steel wire, being careful to clean out every crevice, so that after the brooms are through only the clean bauxite surface remains. A rain that washes in a little sand may call for another sweeping before the holes are shot.

***The surface workings cover a large area. Sixteen miles of narrow gage track connect them with the plant***

Underground work is by a retreating system. A tunnel is driven through to the end of the block that is to be worked and the bauxite taken out, leaving the necessary pillars and about 6 ft. for a roof. When the block has been worked to this extent the roof and pillars are taken in retreat, allowing the surface to cave.

### *Quarrying Methods*

The open cut or quarry methods are quite different from those ordinarily used in limestone and other common rocks. Well drills were tried out thoroughly and did not prove successful. The best method found has been to put down 2-in. holes with Denver Rock Drill Co.'s air hammer drills. These are put down to the bottom of the deposit and given about 15 ft. burden. If the deposit is so deep that it is uneconomical to drill with the air hammer drills the holes are finished with churn drills, and some holes are put down altogether with churn drills, where it does not pay to run air pipes and bring the equipment from a distance.

The holes are sprung at the bottom and loaded either with ordinary 40% dynamite or, if the hole is wet, with 40% gelatine.

***Hand loading in one of the quarries***

***Steam shovel loading. Note length of train pulled by dinkey***

Both black powder and 20% dynamite have been used, but the 40% powder seems to give the best results. The rock fragments unevenly because it is uneven in hardness. There is a sort of crust in the upper 2 ft. in many places which breaks into large blocks. The larger pieces are set aside when cars are loaded and blockholed later. Denver Rock Drill air hammers are used for this work, too, but with drills of a different type.

Loading the broken rock on the cars is by hand or by a steam shovel, according to which method is better adapted to the part of the deposit being worked. If any sorting has to be done, hand loading must be employed. The difference in cost is not much under any circumstances and under some circumstances hand loading is actually cheaper. Care of course has to be taken not to get any sand in with the fines that are shot down from the face and it is sometimes necessary to clean the floor thoroughly before shooting. The company has several Bucyrus shovels of different sizes which are used for shovel loading.

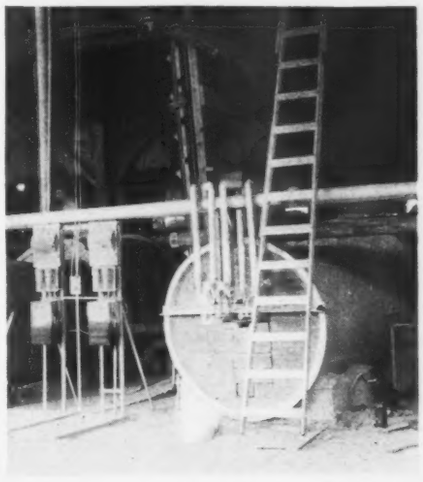
***The 36-in. gage tracks are laid with 60-lb. rail and well ballasted***

The cars used are of a type developed for use in this deposit and resemble somewhat the cars used in coal mining in that they have a high sided body and a low truck. This is because the same type of car is used underground and on the surface. The gage of the track is 36 in. and 60 lb. rails are used throughout. The care with which the main tracks are constructed is quite unusual in quarry practice. The grade is carefully maintained, the rails are laid on No. 1 oak ties and the track is well ballasted. The work is fully as good as on branch lines of railroads and better than it is on some lines. Cars are hauled in by good sized steam dinkeys, about 30 cars to a train.

***Drying plant (machine shops and warehouses in front). Each kiln has its own stack***

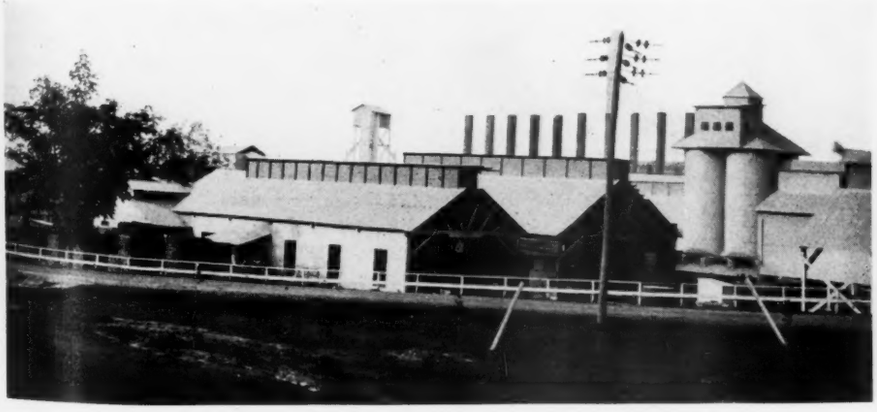
### *Crushing and Drying*

The crushing and drying plant is in a series of buildings extending for several hundred feet. Cars are brought into a shed on an upper level and dumped to the crusher in a peculiar way. The car to be dumped is pushed on to a section of track which is pivoted and the car is automatically chocked and clamped so that it cannot leave the rails. Then an arm from below pushes up the back end of the car and this pours the contents of the car through a hole above the crusher. The hole is covered by a short section of track which drops down as the car is emptied and returns to place when the back end of the car is on the floor level. Then the car is pushed over the hole and on to a circular track by which it is sent to the track on which a train of empties is being made up. The operation of this dumper is fast and positive.



***Oil burners used to fire drying kilns***

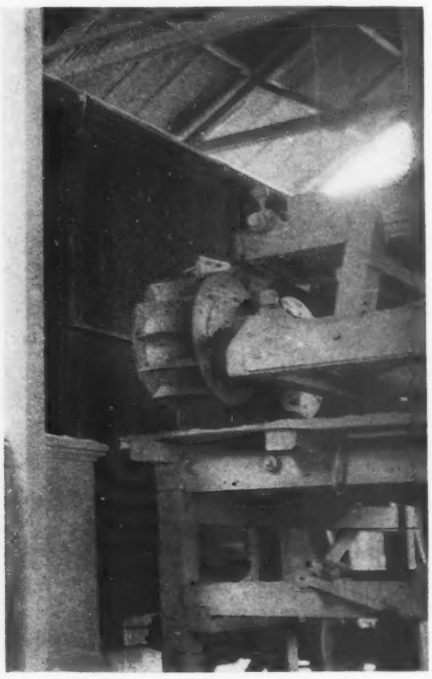
The crusher into which the cars are dumped is called the Gibbons mill, from the name of the inventor who developed it at



***Mine portal and mine shops***

this plant. It is a form of roll with two ringed cylinders which mesh so that they serve as both crusher and grizzly. Such a machine might find some application in crushing the softer limestone and chalks that are used in many places for making cement. There are gyratory crushers in the plant, but they are not much used now.

Crushing is to 3-in. and finer and its main purpose is to prepare the rock for the dryers. These are cylinders like the rotary kilns used



***Double paddle wheel arrangement for loading cars***

in making cement, 60 ft. long and 7 ft. in diameter. There are 10 of them in service. Some have straight sides and some are of the bottle-neck type with a coned section near the center. The straight sided cylinder is considered the better for this particular kind of drying.

The bauxite as mined or quarried contains 14% of moisture even when the surface is dry, and with wet surfaces the moisture content of a car may run 16% or 18%. One of the main purposes of drying is to reduce freight charges, as most of the output has to be shipped a considerable distance. Oil is used as fuel for drying and natural gas has also been used. Naturally powdered coal could not well be used on account of its adding silica from the ash. The dried bauxite is loaded into box cars by a device which has been developed at this plant. It consists of two paddle wheels with shrouded ends running in opposite directions. The bauxite falls on them from a belt conveyor and is thrown by the paddle wheels to both ends of the car.

### *Calcining*

Bauxite which is intended for the making of abrasives must not only be dried but it must be calcined. The calcining plant is situated a short distance from the drying plant and connected with a series of conveying belts. The calcining is done in rotary kilns much like those used in drying but subject to a much higher temperature. The purpose of the calcining is to remove combined water.

The kilns used at this plant were made by various well known manufacturers and they are driven by motors of different makes. The electrical equipment was also supplied by different makers; in fact, it was stated that about all the well known makers of motors had machines somewhere in this plant.

### *Personnel Work*

In an operation of this size with some hundreds of men employed the personnel work becomes of the greatest importance. This company's methods have been unusually efficient and the labor turnover is very low. Most of the men employed have been with the company for years and do not think of looking for other work. Both white and colored labor are employed. During the after-the-war period when colored labor everywhere through the south became restless, some colored laborers went to the big cities in the northern states, but many of them have now returned to their old jobs and are the more contented from having tried working in other places.

The town is called Bauxite and has its own postoffice and railroad station. The houses belonging to the company are neat and well painted and cared for and are rented at very low prices. Some that rent for $6 and even $3 per month are neat and thoroughly liveable, not at all resembling the poor unpainted shacks that are found around so many mining camps. Water gas for cooking and electric lights are supplied and the charge for these is $1 per month. A club house and a picture show and a golf course are maintained by the company. The idea is to make things as comfortable for the miners and laborers as possible because, as the superintendent put it, "the fellows who get the good salaries can go with their families to Hot Springs or Little Rock in their cars, when they want a little diversion, but the man who cannot afford a car needs pleasure and amusement just as much as they do."

***Superintendent's office at the plant***

As this is an isolated village, a commissary has to be maintained. This is in a very large building and a walk through the aisles of the store shows that all reasonable needs can be met there just as well as in the large city store. A big soda fountain is perhaps as popular a feature as any.

Driving through the streets of the town with the neat homes, many of them with flower and vegetable gardens, one feels that Bauxite would not be a bad place in which to live and work. There is no air of seclusion about it and a big sign near the main buildings says that visitors are always welcome.

The output is sold to be used in many ways, but mainly for making abrasives, chemicals and metallic aluminum. About 70% roughly, goes to make aluminum and 15% each to abrasives and chemical industries. A great deal of the aluminum sulphate made from bauxite is used in water purification plants. Refractories of a high class also contain bauxite and this use of the mineral is increasing.

The main office of the company is in Philadelphia. L. R. Branting, superintendent, is in charge of the entire operation at Bauxite.

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## Microscopic Analysis of Feldspar

THIS recent investigation reported in the September, 1927 number of the *Journal of the American Ceranic Society*, appears to have interesting possibilities to the rock products industries, particularly in determining the constitution of portland cement clinker. The apparatus used and the inductive methods followed might easily be applied, after suitable modifications, to this end. The present petrographic analysis of clinker is confined chiefly to the qualitative and any new optical method which might be used to determine quantitative proportions of the clinker constituents would constitute a step forward in the technology of portland cement.

Nineteen commercial feldspars were examined by this method and the results compared with results obtained by computing the chemical analyses of the mineral constituents. The method of deriving the quantitative amounts differed from the usual; in this investigation a simple count of the grains in the field was made and classified as to whether their indices of refraction were above or below the index of the immersion fluid. Immersion fluids of different indices were used to distinguish the constituents.

It is concluded that, while neither the counting method nor the fusion method is as accurate as chemical analysis, the counting method gives satisfactory results for plant control in terms of potash feldspar, plagioclase feldspar, and quartz when used by a skilled microscopist.

# British Research on Lime and Lime Mortars

## A Summary of Existing Information Preparatory to an Extensive Research Program

A COMMON complaint of American lime manufacturers is that too much attention has been paid to research in connection with lime for chemical purposes, and too little to lime for use in building operations. This is undoubtedly a justified complaint. Too frequently it is assumed that everything is known that can be known about the various kinds of lime used in building operations. As a matter of fact, practically nothing definite is known, and the field of research in building limes and building lime products is hardly scratched.

In Great Britain it has been different. There lime is produced in almost as many varieties as in this country, and the building industries use by far the greater part of the production. Therefore a new bulletin, "Lime and Lime Mortars," by A. D. Cowper, published by the Department of Scientific and Industrial Research as "Building Research, Special Report No. 9," is of very particular interest and value. It is, so far as we know, the first attempt in the English language to completely classify and standardize limes used in building operations.

The report contains about 80 pp. and the following chapter headings give an idea of its scope: Historical; the process of lime burning; classification; the uses of lime in building; lime washes (white washes); lime plaster; pozzolanas; mortars and concrete; specifications; bibliography, glossary of terms. It is gratifying to the editors that ROCK PRODUCTS is particularly referred to in the bibliography as one of the sources of much valuable material used in this study of limes.

The table of classification of building limes, reproduced herewith, is of interest in showing that no attempt whatsoever has been made in the United States to classify hydraulic limes, which form so important a part of the lime production of Great Britain and Europe. While the raw materials for making hydraulic lime exist in great quantity in this country, for many years past not the slightest effort has been made by lime manufacturers to do anything with them. Much effort has been made to find admixtures and "dopes" which would give "fat" limes certain properties, but little or no attempt has been made to find the particular kinds of limestone which would make lime with some of these desirable qualities. Only in recent years have a few cement manufacturers sought and obtained such limes which are made and marketed in this country under mystifying trade names.

### *A Use for the "Impurities" in Limestone*

"Impure" limestones, which the majority of American lime manufacturers cast aside, or sell for commercial crushed stone, are the basis of these hydraulic limes. We quote from the chapter on "Classification" as follows:

"Limes are composed of calcium oxide together with varying amounts of magnesium oxide, depending on the nature of the stone from which they were burnt; and in addition will contain varying amounts of argillaceous matter (clay), which, since it is the cause of valuable hydraulic properties, is not necessarily an undesirable impurity; other compounds are nearly always present which are impurities of no value, and the latter should not exceed 5% by weight of the total.

"The classification of limes is usually founded on the proportions of these ingredients present; and upon the resulting behavior of the burnt lime when brought into contact with water. A further subsidiary classification is used to denote the physical condition of the lime, whether in lump or in powder, or as to whether it is 'Selected,' *i.e.*, a well-burnt lime picked free from ashes, core, clinker and other foreign material, or 'run of kiln,' *i.e.*, without selection (American Society for Testing Materials Classification). A special designation, such as 'chemical lime,' may refer to exceptional chemical purity for certain manufacturing processes in which this is essential.

"A distinction can be drawn between: Calcium limes, containing 85% or over of calcium oxide; and magnesian limes, containing over 10 to 20% of magnesium oxide. Some Italian limes will contain up to 40% of magnesia, and 4 to 9% is common in 'fat' Italian limes. Eckel states that while an American lime containing over 5% of magnesia may be classified as 'magnesian,' such limes will usually contain over 30% of magnesia. American classification distinguishes high calcium, calcium, magnesian and high magnesian limes respectively (American Society for Testing Materials; and American National Lime Association).

"From a chemical standpoint, the principal point of distinction is the type of *impurity* present. However, the estimation of the hydraulic properties of clay substance is a matter of considerable difficulty, especially when, as is the case at the moment, the particular compounds to which these properties are due are not known with any certainty. Undoubtedly they are due in many cases to a particular type of active silica often known as 'soluble silica'* but this is not necessarily true in all cases. Hence we are, at present, limited almost entirely to practical tests.

### *The Vicat Classification*

"The most satisfactory classification is perhaps a slight modification of Vicat's historic scheme. In accordance with this, limes are divided into the following classes:

"Class A—Rich or Fat Limes.

"Class B—Poor or Lean Limes.

"Class C1—Slightly or Feebly Hydraulic Limes.

"Class C 2—Moderately Hydraulic Limes.

"Class C 3—Eminently Hydraulic Limes.

"The differentiation of these classes is effected by the following simple tests as originally put forward by Vicat himself:

### *Testing Hydraulicity: Practical Tests*

"The lime, freshly burnt and broken to walnut size, is put into a cloth bag of open material or a basket, a volume of about a quart being used; and is immersed for not more than five seconds in pure water, then drained a moment and emptied into a stone or cast-iron mortar. The behavior of the lime subsequently is closely observed: the lime may immediately commence to hiss, decrepitate, swell up and give off steam, and at the same time may fall into powder; there may be a period of inactivity of five minutes, after which the same phenomena may be observed; or only after 15 minutes have elapsed, in which case the decrepitation and steaming are much less marked; a whole hour may elapse before any change is observed, when the action is again greatly moderated, so that but little heat is disengaged; or in extreme cases there may be no visible change for long periods of time.

"As soon as the lime shows signs of breaking up, water is added carefully down the side of the vessel, the lime is stirred up with a spatula and finally is worked up by a pestle to the consistence of a stiff clay, more water being added if necessary. It is then left for a couple of hours, or until perfectly cold.

"After standing, the lime paste is then worked up again with the pestle, with the addition of more water if required, to the consistence of potter's clay, and sufficient is placed in a small pot or glass jar, of greater height than width, so as to fill it approxi-

*A method of estimating this "soluble silica" is in process of development in the Building Research Station.

mately two-thirds full. The lime is caused to settle down in the pot by striking the bottom of it on the palm of the hand or on a block, and the whole is then placed standing in a vessel of water so that it is immersed. Any change in consistence of the material is then observed over a considerable time.

"The division of limes into Vicat's classes follows then according to their behavior during slaking and subsequent storing under water.

"Class A or Fat Limes slake rapidly and energetically, and have their volume doubled, or more, in the process; their consistence remains sensibly the same after many years of immersion in water under the conditions of the test; and they dissolve practically completely in pure water frequently changed.

"Class B or Lean Limes slake slowly, with little or no increase in volume, and behave in water in a similar manner to the Fat Limes, except that they leave a residue devoid of any consistence on solution in many changes of water.

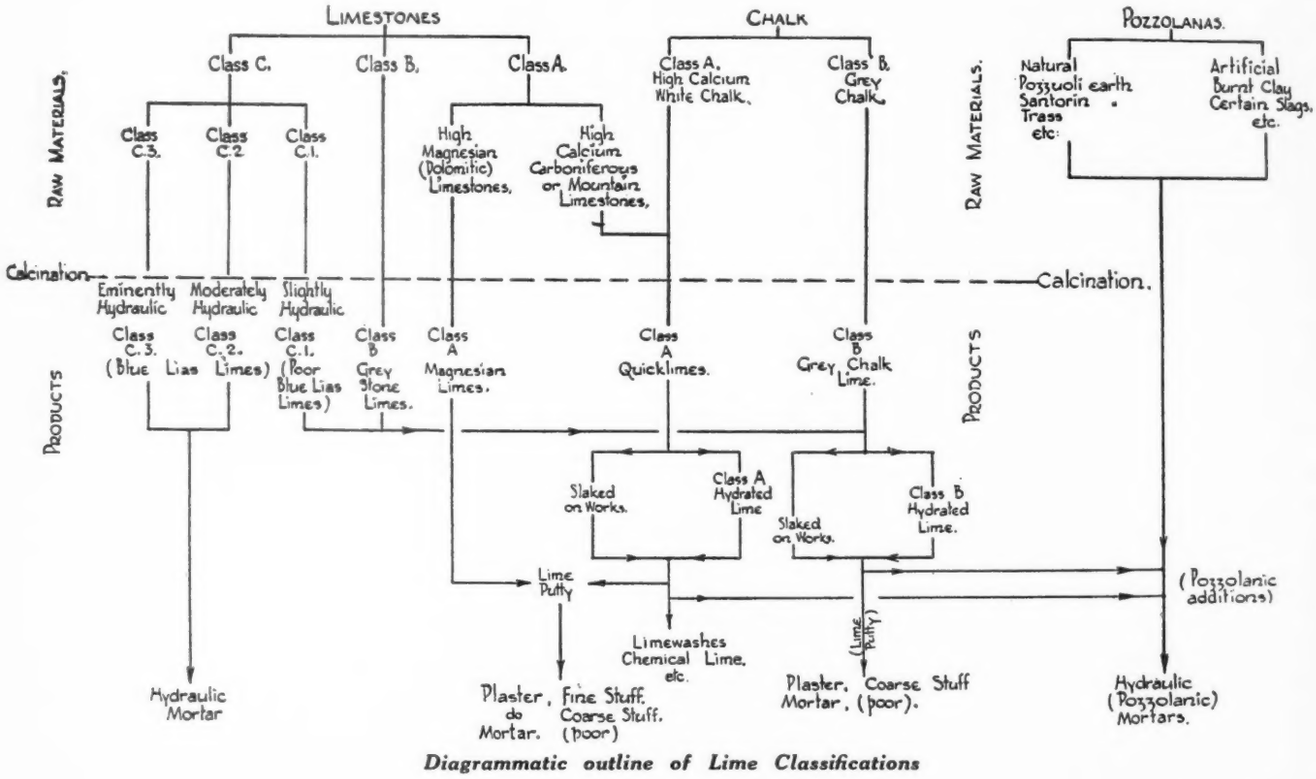
"Class C 2, Moderately Hydraulic Limes, set in 15 or 20 days after immersion, and continue to harden; but after six or eight months the process becomes slow. After one year this consistence is about equal to that of hard soap. They dissolve in water with great difficulty (leaving of course an appreciable residue); the expansion on slaking is small.

"Class C 1, Feebly Hydraulic Limes, will be intermediate between this Class C 2 and Class B.

"Class C 3, Eminently Hydraulic Limes, set at some time between the second and the fourth day of immersion. After one month they are already very hard and altogether insoluble. At six months they appear like the absorbent calcareous stones, splintering under a blow and presenting a slaty fracture. The expansion on slaking is small.

"It will be seen that a certain amount of time is necessary even for the preliminary stages of these tests; accordingly the determination as to in which class a lime is to be placed cannot be done immediately, though a chemical analysis (by indicating the proportion of argillaceous matter present) will give valuable information to an experienced man.

"As a guide, Vicat's approximate figures for the proportion of inert and argillaceous matter present in the different types of limes may be given here: Class A, below 60% of (inert) silica, alumina, iron, etc.; Class B, below 30% of inert impurities; Class C 1, below 12% of clay, etc. (as *active* ingredients); Class C 2, up to 18% of clay, etc., silica predominating; and Class C 3, up to 25% of the hydraulic ingredients, silica again predominating. It will be noted again that it is extremely difficult to distinguish, by analysis only, between silica and alumina which are merely inert adulterants of the lime, acting as so much fine sand; and silica and alumina which, as clay-substance, exert the favorable hydraulic effect. Modern practice allows of a higher percentage of hydraulic ingredients, up to 36% in a good eminently hydraulic lime.




***Diagrammatic outline of Lime Classifications***

### *Other Tests*

"To distinguish between a calcium and a magnesian lime a chemical analysis is both necessary and conclusive, though in the first instance suspicions may have been aroused by the relative speed and energy of slaking, and degree of expansion, exhibited in Vicat's slaking test, magnesian limes showing the least.

"To distinguish a Class A lime, a small quantity of it is treated, after slaking in excess of water, with a little dilute hydrochloric or nitric acid. The amount of residue, estimated by eye, indicates the type; the rich lime dissolves at once and practically completely, the others will leave an appreciable quantity of fine residue devoid of structure or consistence. This test can be carried out in a few minutes in a cup or other small vessel. Fragments of the original limestone can be tested similarly: a high calcium or magnesium limestone will dissolve with effervescence, the magnesium with notably less energy, leaving practically no residue; a dolomite will dissolve slowly in cold dilute acid, but will finally go completely into solution if pure; a hydraulic stone will leave an appreciable insoluble residue. A poor lean limestone will similarly leave an insoluble residue.

### *Hydraulic Index*

"The hydraulic quality of a lime may be defined more nearly by the value of the 'hydraulic index,' which is used in conjunction with cements. This is a ratio between the constituents of the lime, which is expressed thus:

$$\frac{\text{Percentage of silica} + \text{percentage of alumina}}{\text{Percentage of lime}}$$

"Ordinary limes show a hydraulic index

less than 0·1; feebly hydraulic from 0·1 to 0·2; good hydraulic limes will give from 0·2 to 0·4, while portland cements and natural cements run from about 0·4 to 1·5 and over; a pozzolana will exhibit a hydraulic index over 3.

"A more complex expression, the 'cementation index,' which distinguishes more precisely the effects of the silica, alumina and iron oxide present, has been suggested by Eckel.

"As the hydraulic index was devised in connection with portland cement, in which the magnesia content is always low, it does not include the latter at all; whether a more suitable formula would result from its inclusion cannot be stated without further research.

***Geological Classification of Limestone***

"A possible classification of limes would

## CLASSIFICATION SCHEMES—VICAT'S CLASSIFICATION

| — | Class | | | | |
|---|---|---|---|---|---|
| | Fat | Lean | Hydraulic | | |
| | | | Feebly | Moderately | Eminently |
| | A | B | C1 | C2 | C3 |
| Slaking | Rapid : much heat | Moderately slow (5 min.) | Slow (5 to 60 min.) | Very slow | Very slow ; requires fine grinding. |
| Expansion on slaking | 2–3 times | Large | Small | Small | Small. |
| Set in water | ——— | ——— | > 20 days | 15–20 days | 2–4 days. |
| Consistence after one year in water | Putty | Putty | ←Intermediate→ | Hard soap | Stone. |
| Residue on solution in much water | Very small | Small ; devoid of consistence | Appreciable | Insoluble | Insoluble. |
| Residue ditto in HCl | Ditto | Ditto | Ditto | Moderate | Large. |
| Composition (Vicat) | >94% CaO MgO | >70% CaO MgO residue inert | <12% active clay, etc. | >12% <18% active clay, etc. | >18% <25% active clay, etc. |

## SUGGESTED CLASSIFICATION FOR BRITISH STANDARD SPECIFICATION

| | | | | | |
|---|---|---|---|---|---|
| Suggested British classification { CaO + MgO | >95% | <95% >85% | >60% | >60% | >60% |
| { $SiO_2$ + $Al_2O_3$ | | | <15% | >15% <25% | >25% <35% |
| Tensile 1 : 3 | — | — | — | > 75 lb. | 3 days moist air. 25 days water. |

## CLASSIFICATION ADOPTED IN FOREIGN SPECIFICATIONS

| | | | | | |
|---|---|---|---|---|---|
| German classification | "Air Lime" : >28 lb. Tensile 1 : 3. 24 hours moist air, 28 days air | | >28 lb. tensile 21 days moist air 7 days water | "Strongly hydraulic" : >71 lb. 7 days moist air. 21 days water. | |
| Swiss classification | — | — | Hydraulic : >85 lb. Tensile 3 days moist air. 28 days water. | | |
| French classification. Hydraulic modulus = % clay/% lime | 0 to 0·10 | | 0·10 to 0·16 | 0·16 to 0·31 "Properly Termed" 0·31 to 0·42 | 0·42 to 0·50 "Limited" 0·50 to 0·65 |
| | | | Set under water to resist finger in 5 days. | | |
| American : U.S. Govt. Master Specification No. 250 | Ca >95% >75% — <10% < 5% | Mg Do. — >20% Do. Do. | CaO + MgO CaO MgO $CO_2$ $SiO_2$ + $Al_2O_3$ + $Fe_2O_3$ | The sign > means more than The sign < means less than | |
| South African (tentative) | Blue building magnesian lime <6·5% $SiO_2$ | | | | |
| Russian | "Fat Air" | "Lean air" | "Feebly hydraulic" | "Strong hydraulic." | |

be in accordance with the geological formations in which the stones occur. The larger masses of calcium carbonate are marine in origin, and were formed by the deposition of calcareous shells, etc., on the sea-bottom. These limestones, if occurring in areas free from terrestrial deposits, would be very pure, but where such deposits could take place more and more argillaceous matter (derived from the land) would be included. The pure limestone deposits would be a source of fat limes, while the others would yield either lean or hydraulic limes, according to the nature of the additions. Further, the coast deposits would generally be more variable, both in occurrence and constitution. A geological classification gives at the same time a rough geographical classification, and is useful as an intimation as to what type of lime is likely to be most plentiful in a particular district, where a certain geological formation is commonly observed."

There follows a geological and geographical classification of limestones in Great Britain, where the relatively small area involved makes this comparatively easy. Such a geological and geographical classification of American limestone deposits must be attempted before any great progress can be made in the classification of American limes. Owing to the wide territory involved it is of course no small undertaking, but it would certainly be a useful and fundamental step for the U. S. Bureau of Mines or some other government bureau to make toward bringing order out of the present chaos in the lime industry.

### *Making Hydraulic Lime From Pure Limestones*

The hardening of plaster and mortars made of pure limestones—both high calcium and magnesium—is nothing but a drying out, with the formation of a small amount of carbonate binder. The action is largely mechanical, or physical, hence "fat" lime mortars have little or no tensile strength. The conversion of the lime oxide or hydrate to the permanent carbonate form is a slow, long drawn-out process and literally requires centuries, and even then favorable conditions of atmosphere and moisture. Hydraulic limes, on the other hand, harden by chemical reaction between the calcium oxide, silica, alumina and water, just as portland cement hardens. Hence for nearly all building work hydraulic limes are preferable. And hydraulic limes can be, and for centuries have been, made artificially. Again quoting from the report:

"While but little attention has been paid to this subject in Great Britain since the artificial hydraulic cements became common, great progress has been made in other countries in connection with such admixtures, and a considerable literature has accumulated, largely in German and French technical journals, on this topic. Much experimental work has been carried out recently in these countries, more particularly in connection with locally available pozzolanas; so that precise information is beginning to be available for their engineers and builders, and formal specifications have been published for particular materials, such as trass; while important works have been successfully completed on the largest scale in lime-pozzalana and cement-pozzolana concretes, particularly in western Europe. In addition to improved resistance to sea-water, a very sensible economy has often been effected by the use of a pozzolana.

### *Definition of Pozzolanas*

"A substance is said to be pozzolanic when, while not necessarily cementitious by itself, it possesses constituents which will combine with hydrated lime at ordinary temperatures in the presence of moisture to form stable insoluble compounds of cementitious value. When added to lime mortar in addition to or in partial substitution for the sand it will impart to it hydraulic properties and greater strength. When added to concretes and mortars made with portland and similar cements, by the consequent removal of the free lime, it will impart to the material an increased degree of resistance to various agencies which are normally liable to cause disintegration.

### *Strength of Mortars*

"The ancient Romans were able to produce magnificent long-enduring and watertight structures with lime mortar by the use of the *volcanic sand* from the neighborhood of Mount Vesuvius. All disinterested authorities are unanimous in admitting the limited degree of strength developed in ordinary Class A fat lime and sand mortars when in thick masses, or in the interior of solid walls and masonry pillars, etc., and the excessively slow nature of the process of carbonation to which is to be attributed any hardening after the first set and desiccation of the mass.

### *Roman Pozzolana*

"In connection with the Classification of Limes, mention was made of the hydraulic limes, which have a definite setting power independent of absorption of atmospheric carbon dioxide, and hence are able to harden under water. These were limes containing argillaceous matter, *i.e.,* hydrated aluminum silicate, and therefore combined silica. The ancient Greeks and Romans had found (and the fact was utilized by Smeaton in the historic instance of the building of the Eddystone lighthouse) that the clayey or siliceous matters do not need to be already present as an ingredient in the limestone before burning, but can be added subsequently, provided only that these additions are 'pozzolanic.' Then the mortar resulting from the admixture of pozzolanic material with the slaked lime and sand will show marked hydraulic properties and a development of considerable strength on setting independent of any slow and uncertain process of carbonation, even though a fat, non-hydraulic lime had been used. In spite of the competition of artificial portland cement, such pozzolanic lime-cements are still prepared, and have been used on a large scale outside of Great Britain (particularly in districts where a good pozzolana is available) in massive works where the ultimate degree of mechanical strength is not called for, and where cost of production is an important item.

### *Classification*

"Pozzolanas can be roughly divided into (A) natural pozzolanas, (B) artificial (*i.e.,* artificially burnt) pozzolanas. (A) The *natural pozzolanas* are principally clayey or siliceous matters of volcanic origin, which have experienced in their formation a heat treatment analogous to that which we give to the artificial substitutes. The characteristic example is the historic 'pozzolana' (puzzolana, pozzuolana) named after the town of Pozzuoli, near Naples and Mount Vesuvius, in Italy, where it abounds. This has been worked for centuries by small open pits, the material being simply screened and ground without any particular control, being therefore of variable quality. A similar material is found in areas in the southeast of France, in the Azores and in the Canary Islands ('tosca') whence it is exported. Some of the French pozzolana and the 'tetin' from Azores has a large percentage of iron (ferric oxide) present, and is reddish in color. Recently, experiments have been tried with Japanese volcanic ash.

"An important pozzolanic material, which has become better known of late years in Germany, is 'trass,' an ancient volcanic mud occurring along the Rhine, particularly at Andernach, near Coblenz. This is now a yellow-grey rock of a pumice-like nature, of chemical composition very closely resembling that of Italian pozzolana, but in general with a rather lower iron content. The 'Santorin' ash, from one of the Grecian isles, has a high content of silica and but little iron present. The composition of most of these natural pozzolanas shows about 50% of silica and around 30% of alumina and iron, together with small quantities of lime and smaller of magnesia, as main constituents.

"Feebly pozzolanic materials are of fairly common occurrence: 'arenes,' 'psammites' and sands from the decay of igneous rocks, particularly basic rocks such as basalt; and from schists. These have not had the same thermal treatment as the genuine pozzolanas, but give when used in place of ordinary sands an ultimate strength considerably above that of a fat-lime-sand mortar. The action is apparently the same as with the volcanic pozzolanas, their activity being possibly due to the presence of notable proportions of 'soluble' silica, which can unite with the lime to form calcium silicates.

"(B) *Artificial pozzolanic materials* include pounded bricks and tiles ('potsherds,' of historic interest), burnt clay and granulated blast-furnace slag. The last is used in the

slag-cement industry, where a liquid slag is finely granulated by bringing it into contact with water or steam, then dried and ground.

"Burnt clay, burnt to a light terra-cotta color, has been used effectively as an artificial pozzolana; *e.g.*, in the Asyut Nile Barrage, 1902. The common use of potsherds in early historical times has been mentioned in the first section; some ground bricks form a convenient modern substitute for these, and if added to a fat lime mortar will have similar effect on the setting powers, strength and hydraulic qualities of the lime. Burnt clay, 'surkhi,' is commonly used for this purpose in India.

"Other artificial pozzolanic materials which have been tried or suggested for use are spent oil shales, residues from aluminum manufacture, 'Si-Stoff,' burnt 'gaize,' lightly burnt pozzolanic earths and clinker. An interesting application of pozzolana is that of addition to a portland cement in order to fix the free lime normally present in set portland cement, for fireproofing purposes; baked clay burnt at a temperature around 850 deg. C. proving effective in this capacity when ground to a degree of sufficient fineness.

***Practical Test for Pozzolanic Properties***

"A simple practical test to determine whether a given sample of burnt clay or other material possesses pozzolanic properties, and (to some extent) to obtain a measure of its relative activity as compared with other samples, is that utilized in connection with the investigation on the fireproofing of portland cement by the addition of pozzolanas to combine with the free lime already referred to. This consists in adding a small quantity of the material, finely powdered, to rather less than its weight of slaked lime, in a tube or small narrow bottle, and covering it to a depth of a couple of inches with pure water, shaking up every 12 hours for a week and then observing the appearance of the tube (shortly after shaking) and the bulk of the sediment as compared with a fresh mixture or with another pozzolana similarly treated. The actual quantities recommended are 0.5 gm. powdered pozzolana, 0.3 gm. slaked lime and 20 c.c. distilled water, in medium-sized test-tubes.

"The interaction between the solution of lime in water and the pozzolana will give rise to hydrated calcium alumino-silicates of complex or indefinite chemical structure; these hydrates will be formed in the colloidal condition, and are much more bulky than the clay or lime, with the result that after seven days the tube will contain an increased volume of solid matter as measured by the height it extends up the tube, also the rate of settlement, owing to its flocculent nature, will be slower; the activity of the pozzolana can therefore be judged by inspecting the tubes at different times after shaking. In comparison, the volume of the solid matter in a similar tube immediately after mixing will be much smaller, and it will settle almost immediately.

AVERAGE ANALYSIS, NATURAL POZZOLANAS
(31 Samples)

| | Per cent |
|---|---|
| Silica | 42-66 |
| Alumina | 15-17 |
| Iron oxide | 4-19 |
| Lime | 3- 7 |
| Magnesia | 5- 7 |
| Water | 4- 9 |

From Eckel, *Cements, Limes and Plasters.*

***Strength of Hydraulic Lime Mortars***

"With hydraulic lime mortars, appreciable tensile strength can be exhibited; figures ranging from 46 lb. to nearly 300 lb. per sq. in. are given for mortars of different

## TENTATIVE STANDARD SPECIFICATIONS FOR QUICKLIME, HYDRATED LIME, AND HYDRAULIC LIME

### For Use in Building Construction

*Summary of Tests*

| Test | Quicklime | | | Hydrated Lime | | Hydraulic Lime | | |
|---|---|---|---|---|---|---|---|---|
| | Class A | High Magnesian Class A | Class B | Class A | Class B | Class C 1 | Class C 2 | Class C 3 |
| *Composition* | Not less than 95% CaO & MgO*<br>Not more than 10% $CO_2$<br>—<br>* On ignited sample. | Not less than 95% CaO & MgO*<br>Not more than 10% $CO_2$<br>Over 20% MgO* | Not less than 85% CaO & MgO*<br>Not more than 10% $CO_2$<br>— | Not less than 95% CaO & MgO*<br>Not more than 5% $CO_2$<br>— | Not less than 85% CaO & MgO*<br>Not more than 5% $CO_2$<br>— | Not less than 60% CaO & MgO*<br>Not more than 10% $CO_2$<br>Not more than 15% $SiO_2$ & $Al_2O_3$* | Not less than 60% CaO & MgO*<br>Not more than 10% $CO_2$<br>Not more than 25%<br>Not less than 15% $SiO_2$ & $Al_2O_3$* | Not less than 60% CaO & MgO*<br>Not more than 10% $CO_2$<br>Not more than 35%<br>Not less than 25% SiO & $Al_2O_3$* |
| *Fineness and Residue* | Not over 5% when washed through No. 20 sieve | | | All through No. 20 sieve<br>Not more than 10% on No. 200 sieve<br>Not more than 1% on No. 50 sieve | All through No. 20 sieve<br>Not more than 15% on No. 200 sieve | *Either* not over 5% when washed through No. 20 sieve<br>*Or* ground to pass No. 20 sieve, and not over 15% retained on No. 200 sieve | | |
| *Soundness* | — | — | — | Accelerated steaming test on ¼" sand-lime pat, 2 days old; 5 hours in steam | — | — | | |
| *Tensile Strength*, 3:1 (wt.), Standard Sand-Lime Briquettes | — | — | — | — | — | — | At 28 days: Stored 72 hrs. in moist air, balance of 25 days in water: not less than 75 lb./sq. in. | |

degrees of hydraulicity and for one year old samples. On the other hand, in connection with fat lime mortars, it is well known that the samples may fall apart in the attempt to fix them in the machine to determine tensile strength or adhesion after 'setting' for a considerable time. A comprehensive series of tests with high-calcium, lean and hydraulic limes, in conjunction with four different types of sand, carried out in 1911 by Dibdin for the Royal Institute of British Architects, brought out clearly the difference between the various types of lime, in setting power and ultimate strength developed. Extensive data for Continental hydraulic limes are also given by Burchartz (1912)."

The report contains much other material of interest and value to lime manufacturers. What we have extracted is sufficient to show that research in lime need not be confined to high calcium lime for chemical uses; a field equally important is natural and artificial hydraulic limes for many common uses in building, such as plaster and mortar, and for many special uses in construction yet to be discovered and developed in the future.

# Increasing Sales of Agricultural Limestone

By G. P. Walker
Associate in Soils, Purdue University, Lafayette, Ind.

THE agricultural field, particularly the middle west, offers a good outlet for by-product screenings from limestone crushing operations. This fine material is just what the farmer wants and the use of it for liming acid soils in the middle west has been increasing rapidly during the past few years. Illinois, Ohio and Indiana, with a combined cropped area of about 44,000,000 acres, are now using about 1,200,000 tons of agricultural liming materials annually. Illinois, with an estimated consumption of around 800,000 tons, has probably reached the peak of her demand, as many farmers have entirely covered their farms with rather liberal applications. In Indiana and Ohio the demand should continue to grow, as there are vast areas of acid soils on which liming will pay and many communities are just beginning to adopt a liming program. Ground limestone and screenings make up over 95% of the tonnage used in the middle west and most of this material is shipped in bulk in gondola cars at a price f.o.b. the quarry, usually about the same as or even less than the freight charge. With this low cost and the wide distribution of producing quarries in this section it is natural that farmers are using it almost entirely. The delivered cost runs from $2 to $2.50 per ton compared to $10 to $15 per ton for hydrated lime. Chemical analyses and field experiments show that a ton of pure limestone is equivalent in neutralizing value to ¾ tons of hydrated lime.

### *Demand Concentrated Into Two Months*

Practically all the demand for agricultural stone has come in August and September. During these two dry months the stone is in good condition for spreading and the land for driving over, and for most corn-belt farmers this is a slack season in their normal labor requirements. This peak demand during such a limited season is objectionable for two reasons: (1) It involves a storage and handling problem on the part of the producer which must be passed on to the farmer in higher costs of material, and (2) some producers are finding it hard to make prompt deliveries during this busy period due to the rush of orders. When the farmer has a limited period of time for hauling and spreading a car of stone and delayed shipment runs him past this time it may often result in a very serious inconvenience to him. As a result a good many orders are cancelled during this period and often the sale is lost.

### *Extension of Selling Period Needed*

A practical plan for extending the selling period of agricultural stone over a longer season should be of mutual benefit to producer and farmer. Winter liming has been advocated, but not many farmers feel like risking winter orders because of the danger of either having a car of wet frozen stone to contend with or soft thawed out roads over which it cannot be hauled when it arrives. The plan followed by Frank Goodwin of Crawford county, Illinois, for a number of years seems to offer a practical solution to this problem if enough farmers will follow it.

Mr. Goodwin has limed 700 acres of land since 1913, 600 on his own farm and another 100 which he operates on a lease. After locating a producer on whom he could depend for prompt service he has made a practice of ordering his stone in late spring or early summer when the fields are too wet to work for a day or two. He calls the producer by long distance phone at night and orders his stone to be rushed. His car is loaded and started rolling the next day and the following morning is set on his local siding ready for unloading. He hauls it to the field to be limed and dumps it in one large pile in the corner of the field nearest the road. He then goes ahead with his regular farm work until after the threshing season is over and he has time for spreading it on the land.

### *Finer Ground Limestone Desired*

Farmers are demanding a somewhat finer grade of stone than some delivered to them in the past. A number of producers are changing their screens so as to meet this demand even at the expense of either producing a smaller tonnage or regrinding the coarser stone to a finer condition. Field experiments of the Ohio and Indiana experiment stations show that the finer grade of stone gives better results over a series of years and the farmer can afford to pay a higher cost per ton for finer material of the same purity. Part of the objection has arisen through the delivery of stone of varying degrees of fineness, one car being fairly fine and the next one very coarse. This has been due both to natural segregation in the storage bins and to the continued use of screens after they are badly in need of repairing. That more attention to delivering a more uniform grade of finer stone is justified is indicated by the experience of one producer this past season. He ships a very uniform grade of high quality stone and in spite of the wet months of August and September he enjoyed a nice increase in his business for the year.

## Lime for Pest Control*

By Dr. E. B. Holland
Massachusetts Agricultural Experiment Station, Amherst, Mass.

A CONSIDERABLE amount of lime is used in the manufacture of fungicides for the control of plant diseases. The quality of caustic and hydrated lime required for the preparation of sprays and dusts used in plant protection is an important item. There are several grades and forms of both the caustic and hydrated lime on the market. It is important to mention what seem to be the necessary chemical and physical attributes of these. The following points are worthy of consideration:

1. High calcium limestone.
2. Care exercised in selecting the rock and preventing contamination.
3. Efficiency in burning and slaking.
4. Deterioration in transportation, storage and types of containers.

Caustic or quicklime is known as "fat" lime and should be substantially free from magnesia, carbon dioxide, silica, etc. It is obtainable in three forms—stone or rock-lime, pebble-lime and granulated-lime. The latter is preferable in some respects.

Hydrated lime is offered in several grades of which the so-called chemical hydrate is the most efficient. It is of high calcium content, substantially free from impurities, extremely fine, of good flow or slip and adhesive. Some brands are air-separated. Chemical hydrated lime disperses readily in water and has proved, in field tests, a satisfactory substitute for quicklime in preparing Bordeaux mixture. The use of chemical hydrated lime effects a material saving.

*Abstract of paper read at first annual New England Lime Conference, Amherst, Mass., July 13, 1927. (See ROCK PRODUCTS, August 6, 1927.)

# Air Separation Methods Used in Fine Grinding of Rock Products

## Part VIII—Researches of Dr. Geoffrey Martin on the Theory of Air Separation

By Edmund Shaw
Editor, Rock Products

MENTION has been made in the later numbers of this series of the work of Dr. Geoffrey Martin of London, on air separation, which was undertaken after he had finished his work on the theory of grinding for the British Portland Cement Research Association. This later work was communicated to the British Ceramic Society at Stoke-on-Trent. It is published as Parts VI, V, and Parts VI to VII of his "Researches on the Theory of Fine Grinding." Parts IV and V are printed by Webberly, Ltd., Henley, England, and Parts VI to VII in one issue is printed by William Clowes and Sons, Ltd., of London and Beccles.

Part IV is "On the Air Analysis of Large Quantities of Crushed Sand," and it describes the apparatus for elutriating sand in what are large quantities on a laboratory scale. As the apparatus is only designed for the laboratory, its description hardly belongs here, but it is worth noting that it could be supplied with rising currents from 2-in. per second to 20 ft. per second. A series of velocities in feet per second is given with the average size of particle lifted, running from a current of 0.18 to 0.29 ft. per second (wihch will lift particles of 0.0333 mm. diameter) to currents of 12.86 to 14.64 ft. per second, which will lift particles averaging 0.8325 (about 20-mesh, Tyler standard screen opening).

### *Invariability of Air Separators*

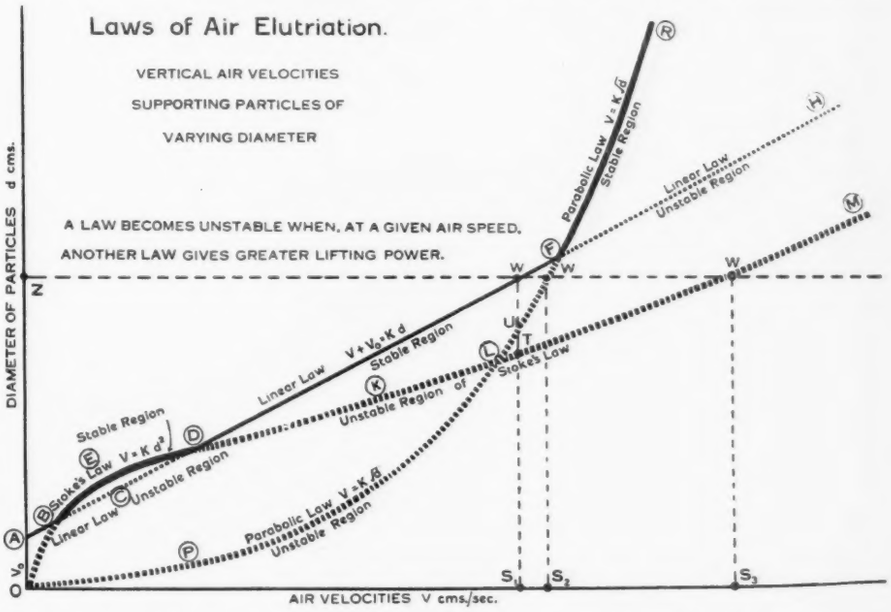
Part V contains research on a point of interest not only to research men but to all users and manufacturers of air separators, since it determines the *invariability* of air separation under constant conditions. The summary attached to the work shows that:

"Crushed sand, when subjected to careful air elutriation, can be separated into grades defined as homogeneous, which are characterized by the fact that no matter how often any one such grade is fractionally elutriated, the average arithmetical diameter of the sand particles composing the grade cannot be altered. Neither can the shape of the distribution curve formed by plotting the frequency number of the particles against their diameters."

Dr. Martin proved this invariability of air elutriation by repeatedly grading sand into fractions and regrading. His curves show that the results obtained in every case was remarkable in their coincidence.

He further shows that this frequency curve follows the probability law, and he brings out a point which is important in the study of fine grinding as well as air separation, which is:

"Such homogeneous grades of sand may be considered as composing the units building up the more complex mixtures which form a complete range of particles coming from a tube mill."




*Illustrating the ranges of the three laws of air elutriation*

But it is in parts VI to VIII that the information most desired by the makers and users of air separators will be found, since this takes up the theory of air separation from the beginning.

### *Laws Governing Fall of Particles*

In the first of this present series something was given of the theory of settling in air and it was noted the finest particles fell according to Stoke's law, and the velocity according to this law gradually increased, as the diameters of the particles studied increased, until at some point the velocity was that ordinarily given for falling bodies generally called the parabolic formula. Dr. Martin has given this general statement exactness by determining where the changes in velocities take place and showing that particles (according to their diameters) fall according to three laws, which are:

For the finest particles, $V = K \cdot d_2$, in which $K$ is a constant, the value depending on the nature and shape of the particle and whether the air is in stream-line or turbulent flow. $V$ is the velocity of a current of air that will *just support* a particle of the diameter $d$, or it is the falling rate, which is the same thing. This equation is known as Law 1. It is a simplified method of stating Stoke's law.

Law 2 is: As the particles grow in size Stoke's law becomes unstable and is replaced by the linear law, $V = K\ (d - d_0)$. $K$ is a constant with the same value as in Law 1, and $d_0$ is another constant.

Law 3 is: When the particles become still larger the linear law becomes unstable and is replaced by another parabolic law, $V = K\sqrt{d}$. This is the usual law of falling bodies and applies to the larger particles when they are subjected to air separation.

The treatise gives the results of experiments and calculation to determine the limits

of these laws. The discussion is too mathematical to be given here, but the results may be noted. According to a table (page 25) the stable region of Stoke's law is with particles from $0.98\times10^{-3}$ cm. to $6.91\times10^{-3}$ cm. These are lifted by streams of air having forces from 0.5 to 25 cm. per second. Above this size (and corresponding velocity of current) the particles enter an unstable region, where the rate is changed to correspond to the linear law. From calculations based on a formula, worked out from experimental data, it is concluded (page 27) that the change from the linear law to the parabolic law occurs when the particle reaches a diameter of 2.1 mm., a particle just lifted by a current of air having a velocity of 1080 cms. per second (about 421 in.).

Particles of this size (about 1/10 of an inch) are much larger than are required to be lifted by air in commercial air separators. Particles which follow Stoke's law (below $6.91\times10^{-3}$ cm., which is slightly smaller than the opening of a standard 200-mesh screen) are separated by air separation, but the bulk of the work is in the coarser sizes of these particles. For ordinary separations then the designer of air separating devices would seem to be most interested in the particles which follow the linear law.

For this, Dr. Martin gives a formula that would seem applicable to all commercial air separation devices designed to work on particles of medium size. For quartz grains lifted by any air speed $V$ cms./sec., the diameter may be calculated as

$$d=0.19105\times10^{-3}\sqrt{}+2\times10^{-3}$$

(Formula 6, page 24.)

However, the practical designer of separators will be more interested in results than in the particular method of obtaining them and he will find these in the tables taken from Dr. Martin's treatise (Part VI-VIII) which are reproduced here. It will be noticed that these tables cover the entire range of particles from those too small to be called by any mesh size up to the coarsest (3-mesh and 4-mesh) that are classed as sand grains. An especially valuable feature is the correlating of the particle sizes with the screens of various systems by which the screen sized familiar to the user may be found without calculation.

TABLE I. PARTICLES GOVERNED BY STOKES LAW

Diameters and Weights of Crushed Quartz Sand Particle lifted by Air at Speeds Ranging from Zero to 328 ft./sec. (100 ms./sec.) together with Mesh Apertures of the Chief Trade Sieves.

Air in Turbulent Flow at 60° F. (15·6° C.).

| | *Velocity of Air* | | *Diameter of particles lifted* | | *Weight of particles* | *Mesh Aperture of various sieves* |
|---|---|---|---|---|---|---|
| | *Cms./sec.* | *Ft./sec.* | *mm.* | *ins.* | *grams* | *inches* |
| Region of Stokes' Law $V=Kd^2$. | 0 | 0 | 0 | | | |
| | 0·5 | 0·016′ (0·2″) | 0·0098 | 0·000386 | $0·71\times10^{-9}$ | |
| | 1·0 | 0·032′ (0·4″) | 0·0138 | 0·000543 | $1·97\times10^{-9}$ | |
| | 2·0 | 0·066′ (0·8″) | 0·0195 | 0·000768 | $5·58\times10^{-9}$ | |
| | 3·0 | 0·098′ (1·2″) | 0·0239 | 0·000941 | $1·03\times10^{-8}$ | |
| | 4·0 | 0·131′ (1·6″) | 0·0276 | 0·00109 | $1·58\times10^{-8}$ | |
| | 5·0 | 0·164′ (1·9″) | 0·0309 | 0·00122 | $2·22\times10^{-8}$ | |
| | 6·0 | 0·197′ (2·4″) | 0·0338 | 0·00133 | $2·91\times10^{-8}$ | |
| | 7·0 | 0·230′ (2·8″) | 0·0366 | 0·00144 | $3·69\times10^{-8}$ | |
| | 8·0 | 0·263′ (3·2″) | 0·0391 | 0·00154 | $4·50\times10^{-8}$ | |
| | 9·0 | 0·295′ (3·5″) | 0·0415 | 0·00163 | $5·38\times10^{-8}$ | |
| | 10·0 | 0·328′ (3·9″) | 0·0437 | 0·00172 | $6·28\times10^{-8}$ | 0·0017=325U.B.S. St. |
| | 11·0 | 0·361′ (4·3″) | 0·0458 | 0·00180 | $7·23\times10^{-8}$ | |
| | 12·0 | 0·394′ (4·7″) | 0·0479 | 0·00189 | $8·27\times10^{-8}$ | |
| | 13·0 | 0·427′ (5·1″) | 0·0498 | 0·00196 | $9·30\times10^{-8}$ | |
| | 14·0 | 0·459′ (5·5″) | 0·0517 | 0·00204 | $1·04\times10^{-7}$ | |
| | 15·0 | 0·492′ (5·9″) | 0·0535 | 0·00211 | $1·15\times10^{-7}$ | 0·0021=270 U.S.B. St. |
| | 20·0 | 0·656′ (7·9″) | 0·0618 | 0·00243 | $1·78\times10^{-7}$ | 0·0024=230 U.S.B. St.<br>0·0025=200 I.M.M. |
| | 25·0 | 0·820′ (9·8″) | 0·0691 | 0·00272 | $2·48\times10^{-7}$ | 0·0029=200 U.S.B. St.<br>0·0029=200 Tyler |
| | 27·5 | 0·902′ (10·8″) | 0·0725 | 0·00295 | $2·87\times10^{-7}$ | Critical Velocity and Diameter. |

TABLE II. PARTICLES GOVERNED BY PARABOLIC LAW

Diameters and Weights of Crushed Quartz Sand Particle lifted by Air at Speeds Ranging from Zero to 328 ft./sec. (100 ms./sec.) together with Mesh Apertures of the Chief Trade Sieves.

Air in Turbulent Flow at 60° F. (15·6° C.).

| | *Velocity of Air* | | *Diameter of particles lifted* | | *Weight of particles* | *Mesh Aperture of various sieves* |
|---|---|---|---|---|---|---|
| | *Cms./sec.* | *Ft./sec.* | *mm.* | *ins.* | *grams* | *inches* |
| Region of Parabolic Law $V=K\sqrt{d}$. | 1,100 | 36·1′ | 2·16 | 0·0850 | $7·59\times10^{-3}$ | 0·0930=8 Tyler<br>0·0937=8 U.S.B. St. |
| | 1,200 | 39·4′ | 2·57 | 0·1012 | $1·28\times10^{-2}$ | 0·1000=5 I.M.M. |
| | 1,300 | 42·7′ | 3·01 | 0·1185 | $2·05\times10^{-2}$ | 0·110=7 U.S.B.St. |
| | 1,400 | 45·9′ | 3·50 | 0·1378 | $3·23\times10^{-2}$ | 0·131=6 Tyler |
| | 1,500 | 49·2′ | 4·01 | 0·158 | $4·87\times10^{-2}$ | 0·132=6 U.S.B. St. |
| | 1,600 | 52·5′ | 4·57 | 0·180 | $7·18\times10^{-2}$ | 0·157=5 U.S.B. St. |
| | 1,700 | 55·8′ | 5·15 | 0·203 | $1·03\times10^{-1}$ | 0·185=4 Tyler |
| | 1,800 | 59·1′ | 5·78 | 0·228 | $1·45\times10^{-1}$ | 0·187=4 U.S.B. St. |
| | 1,900 | 62·3′ | 6·44 | 0·254 | $2·01\times10^{-1}$ | 0·263=3 Tyler |
| | 2,000 | 65·6′ | 7·13 | 0·281 | $2·73\times10^{-1}$ | |
| | 2,369 | 77·7′ | 10·0 | 0·394 | $7·59\times10^{-1}$ | |
| | 2,500 | 82·0′ | 11·15 | 0·439 | 1·04 | |
| | 3,000 | 98·4′ | 16·05 | 0·632 | 3·11 | |
| | 4,000 | 131·3′ | 28·5 | 1·12 | 17·5 | |
| | 5,000 | 164·0′ | 44·6 | 1·76 | 66·7 | |
| | 6,000 | 196·9′ | 64·2 | 2·53 | 198·7 | |
| | 7,000 | 229·7′ | 87·4 | 3·44 | 502·3 | |
| | 8,000 | 262·5′ | 114·1 | 4·49 | 1118 | |
| | 9,000 | 295·3′ | 144·5 | 5·69 | 2227 | |
| | 10,000 | 328·1′ | 178·3 | 7·02 | 4266 | |

### *Influence of Temperature*

The influence of temperature on the falling rate of fine particles is very marked. Dr. Martin gives formulas for calculating this effect and allowing for it with the linear formula. Such an allowance must be made when (for example) particles are settled from the waste gases of kilns and furnaces. But this belongs to the domain of settling rather than separation, hence it is not included here.

This work of Dr. Martin has done for air separation what the work of Rittinger, followed by that of Richards and others did

for hydraulic separation. It has placed the design and operation of air separators on a really scientific basis, substituting exact calculation for rule-of-thumb methods. The rock products and similar industries should be grateful for it, and it is to be hoped that Dr. Martin will be encouraged to go on with his researches and also to publish them in a more substantial form than the pamphlets from which the above has been abstracted.

In the accompanying table to the right the velocities beyond the last division (450-1000) are beyond the limits of experimental results and are extrapolated results.

## Production of Sheet Mica in 1926

THE total quantity of uncut mica sold by producers in the United States in 1926, as reported by the United States Bureau of Mines, Department of Commerce, was 8,129 short tons, valued at $536,827. Of this quantity 1,086 tons (2,172,159 lb.), valued at $400,184, was sheet mica; the rest was scrap mica.

The production was made by nine states, North Carolina, New Hampshire, New Mexico, South Dakota, Virginia, Georgia, Colorado, South Carolina and Connecticut, named in order of total quantity from greatest to least.

DOMESTIC UNCUT MICA SOLD BY PRODUCERS IN THE UNITED STATES IN 1925 AND 1926

| | Sheet Mica | | Scrap Mica | |
|---|---|---|---|---|
| | Pounds | Value | Short tons | Value |
| North Carolina | | | | |
| 1925 | 592,478 | $105,376 | 5,095 | $74,818 |
| 1926 | 700,313 | 150,362 | 2,880 | 54,048 |
| New Hampshire | | | | |
| 1925 | 1,120,857 | 198,858 | 1,953 | 47,525 |
| 1926 | 1,371,890 | 235,890 | 1,738 | 38,213 |
| New Mexico | | | | |
| 1925 | 34,486 | 7,531 | 920 | 14,580 |
| 1926 | 46,104 | 5,824 | 988 | 16,683 |
| Other states* | | | | |
| 1925 | 46,044 | 10,197 | 1,727 | 36,614 |
| 1926 | 53,852 | 8,108 | 1,437 | 27,699 |

The total sales of uncut sheet mica in 1926 showed an increase of 21% in quantity and 24% in value as compared with 1925. The total scrap mica sold showed a decrease of 27% in quantity and 21% in value as compared with 1925. The sales of uncut sheet mica in North Carolina showed an increase of 18% in quantity and 43% in value. New Hampshire showed corresponding increases of 22% in quantity and 19% in value.

The average value per pound of all sheet mica sold in the United States in 1926 was about 18 cents, the same as in 1925, and the average value of scrap mica a short ton was about $19 in 1926, as compared with $18 a ton in 1925. The imports of mica for consumption were 6,318,096 lb., valued at $2,450,834. Corresponding figures for 1925 were 4,901,308 lb., valued at $1,798,827.

*Alabama, Colorado, Conneecticut, Georgia, Maine, Nevada, South Carolina, South Dakota and Virginia.

TABLE III. PARTICLES GOVERNED BY THE LINEAR LAW

| Velocity of Air | | Diameter of particles lifted | | Weight of particles | Mesh Aperture of various sieves |
|---|---|---|---|---|---|
| *Cms./sec.* | *Ft./sec.* | *mm.* | *ins.* | *grams* | *inches* |
| Region of Linear Law $V+V_0=Ka$. | | | | | |
| 30 | 0·984′ (11·8″) | 0·073 | 0·00340 | $3·47\times10^{-7}$ | 0·0033 = 150 I.M.M. |
| 35 | 1·148′ | 0·0866 | 0·00341 | $4·88\times10^{-7}$ | 0·0035 = 170 U.S.B. St. |
| 36·42 | 1·195′ | 0·0896 | 0·00353 | $5·41\times10^{-7}$ | Limit of experimental results above are extrapolated results. |
| 40·54 | 1·330′ | 0·0975 | 0·00384 | $6·98\times10^{-7}$ | 0·0038 = 180 Cement |
| 47·40 | 1·555′ | 0·1106 | 0·00436 | $1·019\times10^{-6}$ | 0·0041 = 140 U.S.B. St.<br>0·0041 = 120 I.M.M.<br>0·0041 = 150 Tyler |
| 58·82 | 1·930′ | 0·1324 | 0·00521 | $1·32\times10^{-6}$ | 0·0050 = 100 I.M.M.<br>0·0055 = 90 I.M.M.<br>0·0057 = 100 E. Amandus Kahl<br>0·0058 = 100 Tyler<br>0·0059 = 100 U.S.B. St. |
| 71·78 | 2·355′ | 0·1571 | 0·00619 | $2·92\times10^{-6}$ | 0·0063 = 80 I.M.M.<br>0·0070 = 80 U.S.B. St.<br>0·0071 = 70 I.M.M. |
| 87·48 | 2·870′ | 0·1872 | 0·00737 | $4·94\times10^{-6}$ | 0·0082 = 60 I.M.M.<br>0·0082 = 65 Tyler<br>0·0083 = 70 U.S.B. St.<br>0·0088 = 76 Cement |
| 105·45 | 3·460′ | 0·2215 | 0·00872 | $8·04\times10^{-6}$ | 0·0098 = 60 U.S.B. St. |
| 121·0 | 3·97′ | 0·2512 | 0·00989 | $1·193\times10^{-5}$ | 0·0100 = 50 I.M.M.<br>0·0117 = 50 U.S.B. St.<br>0·0116 = 40 Tyler |
| 137·9 | 4·525′ | 0·2835 | 0·0112 | $1·1715\times10^{-5}$ | 0·0125 = 40 I.M.M.<br>0·0138 = 45 U.S.B. St.<br>0·0164 = 35 Tyler<br>0·0165 = 40 U.S.B. St. |
| 241·8 | 7·934′ | 0·482 | 0·0190 | $8·43\times10^{-5}$ | 0·0167 = 30 I.M.M.<br>0·0197 = 35 U.S.B. St.<br>0·0225 = 30 Cement<br>0·0232 = 20 Tyler<br>0·0232 = 30 U.S.B. St. |
| 323·5 | 10·61′ | 0·638 | 0·0251 | $1·95\times10^{-4}$ | 0·0250 = 20 I.M.M.<br>0·0280 = 25 U.S.B. St.<br>0·0313 = 16 I.M.M.<br>0·0328 = 20 Tyler |
| 419·0 | 13·75′ | 0·8205 | 0·0323 | $4·16\times10^{-4}$ | 0·0331 = 20 U.S.B. St.<br>0·0336 = 20 Cement |
| 450 | 14·77′ | 0·880 | 0·0346 | $5·14\times10^{-4}$ | 0·0394 = 18 U.S.B. St. |
| 500 | 16·41′ | 0·970 | 0·0384 | $6·98\times10^{-4}$ | 0·0417 = 12 I.M.M.<br>0·0460 = 14 Tyler<br>0·0469 = 16 U.S.B. St. |
| 550 | 18·05′ | 1·071 | 0·0421 | $9·24\times10^{-4}$ | 0·0500 = 10 I.M.M. |
| 600 | 19·7′ | 1·167 | 0·0460 | $1·19\times10^{-3}$ | 0·0555 = 14 U.S.B. St. |
| 650 | 21·3′ | 1·262 | 0·0497 | $1·513\times10^{-3}$ | |
| 700 | 23·0′ | 1·358 | 0·0535 | $1·885\times10^{-3}$ | |
| 800 | 26·25′ | 1·549 | 0·0610 | $2·8\times10^{-3}$ | 0·060 = 8 I.M.M.<br>0·065 = 10 Tyler<br>0·0661 = 12 U.S.B. St. |
| 900 | 29·5′ | 1·72 | 0·0677 | $3·83\times10^{-3}$ | 0·0787 × 10 U.S.B. St. |
| 1,000 | 32·8′ | 1·93 | 0·0760 | $5·67\times10^{-3}$ | |
| 1,081 | 35·5′ | 2·08 | 0·0782 | $6·78\times10^{-3}$ | Critical Velocity and Diameter |

# Gravel Plant Washing and Screening Equipment and Design

## Part IV.—Types of Elevators and Feeders

By Hugo W. Weimer
Consulting Engineer, Milwaukee, Wis.

TO obtain a certain desired capacity from a gravel plant it is not only necessary that the various units be of suitable size but, equally as important, a steady and continuous stream of material must at all times flow through the plant. Whether the installation be large or small, a receiving bin or hopper is usually the first unit in the plant proper, and following this should be some type of feeder to insure the proper flow of material. Without some such device it is very difficult to guard against excessive peak loads at one moment and lost time the next.

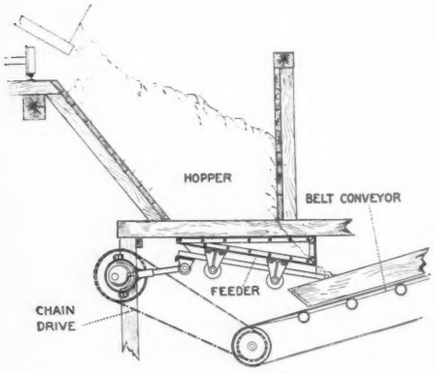



***Fig. 2. Another form of the reciprocating plate feeder***

Two of the most popular types of feeders are the apron feeder and the reciprocating-plate feeder. Fig. 1 illustrates a typical design of the reciprocating type, consisting of a plate which is moved forward and backward by a rod attached to the eccentric mounted on the driving shaft. The design shown is a self-contained unit, simple in construction and satisfactory in operation. The movable plate is supported on rollers and each forward movement discharges a certain amount of material. While the width of the feeder plate is the principal factor in determining the capacity, the speed and stroke likewise govern this feature. The length of the stroke can be varied with some makes by an adjustment in the eccentric.

For handling material containing more than the usual amount of water, this feeder is probably better than most other types, and is very popular with the small and medium size plants and is even being used in some large installations. The usual width of the feeder plate is from 12 to 24 in., and for these sizes less than 2 hp. is required to operate. Very often the drive is taken from the tail pulley of a belt conveyor, as illustrated in Fig. 2, which shows another design of this type of feeder, and its application with a receiving bin and discharging the aggregate to a belt conveyor.

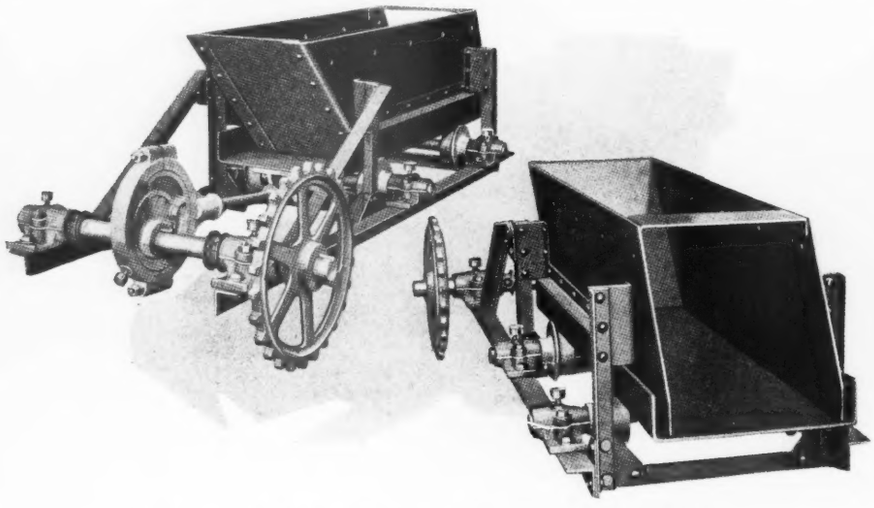


***Fig. 1. Typical design of reciprocating-plate feeder***

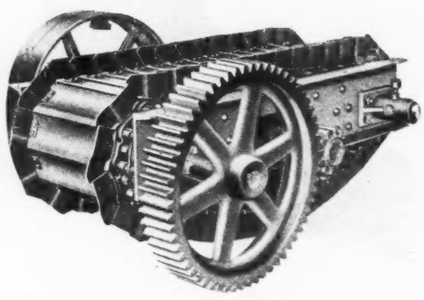


***Fig. 3. Apron type feeder for larger capacities***

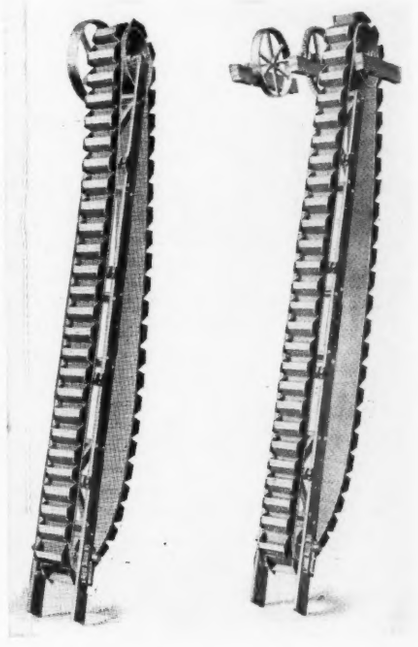


***Fig. 5. Direct and gear driven elevators of the continuous belt and bucket type***

For larger capacities the apron type of feeder is usually used, one design of which is shown in Fig. 3, consisting of steel plates on pans mounted on two strands of chain, operating on sprockets at each end. One sprocket shaft is extended and fitted with a gear which is driven from a pinion on the drive shaft. These feeders are built in various widths from about 18 to 60 in. and operate very slowly, but are capable of handling large tonnages. The power requirements for equal size are no greater than for the reciprocating feeder. Fig. 4 gives the outline dimensions of another design of this type of feeder. It is not possible for the

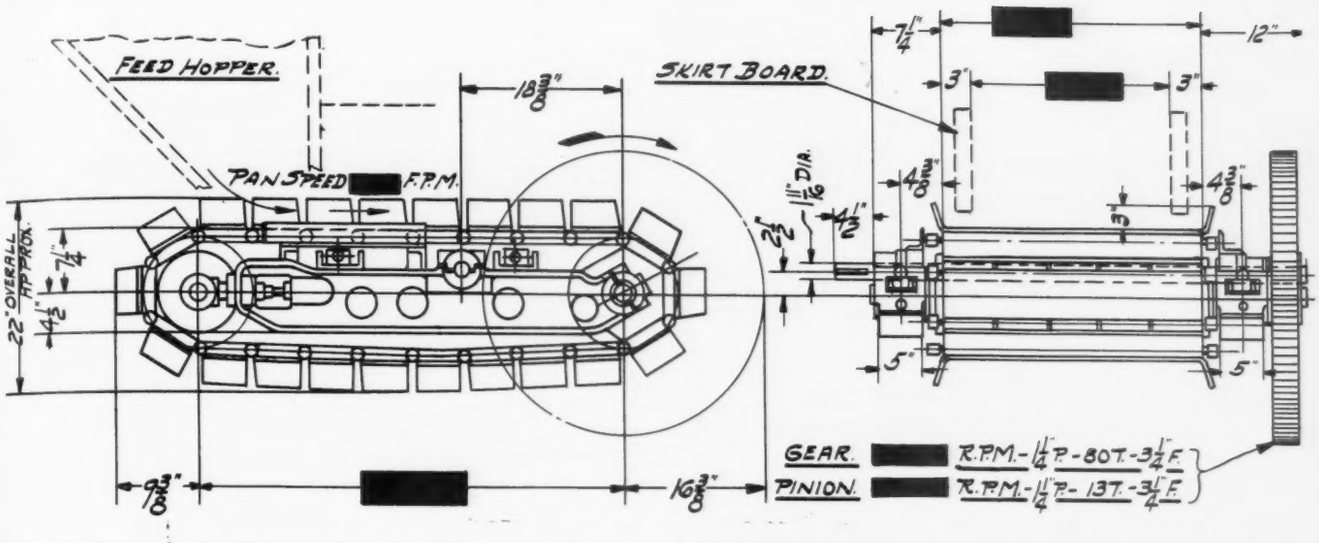



*Fig. 4. Outline dimensions of a design of apron feeder*

NOMINAL STD. WIDTHS.- 18", 24", 30", 36", 42", 48", 54", 60"
STD. CENTER LENGTHS. - 3 FT. 4 FT. 5 FT. 6 FT.
No CARRYING ROLLERS. - 3 FT. CENTERS - 1 ROLL
4 FT. " 2 "
5 FT. " 3 "
6 FT. " 3 "

writer to illustrate or even mention all the types of feeders used in gravel plants at this time, but for the average plant the operator cannot go far wrong if he is familiar with the two types mentioned and chooses the one best adapted for his purpose. Details of construction differ with the various manufacturer's design, but the principle of operation remains the same.

### *Choosing the Proper Elevator*

To elevate aggregate in connection with a sand and gravel plant is always a serious problem and often the choice lies between the use of belt conveyors or bucket elevators. In the stone industry bucket elevators are used extensively with good results, but for sand and gravel it is best to use belt conveyors whenever possible. The cost of upkeep is undoubtedly greater with bucket elevators, and, furthermore, the nature of the material is such that it will stick to the buckets and cause considerable back spillage.

If it is necessary or advisable to use an elevator, then a choice must be made between the chain type or belt type. For the average installation the continuous bucket belt type as shown in Figs. 5 and 6 is probably the best. Care should be taken in choosing a bucket of ample size, because it is cheaper to operate an elevator with large buckets only partially filled than one with smaller buckets that are continually overloaded. To prevent belt slippage, which causes much unnecessary wear and annoyance, it is best to have the head pulley lagged, and if driven by means of a belt pulley on the pinion or drive shaft, the belt should be of more than the usual width for the power requirements to prevent reversal of the bucket belt and to further guard against this occurring it is well to use some safety device on the elevator drive shaft similar to that shown in Fig. 7. Arrangements of this kind absolutely prevent reversal of the bucket belt travel.

*(To be continued)*

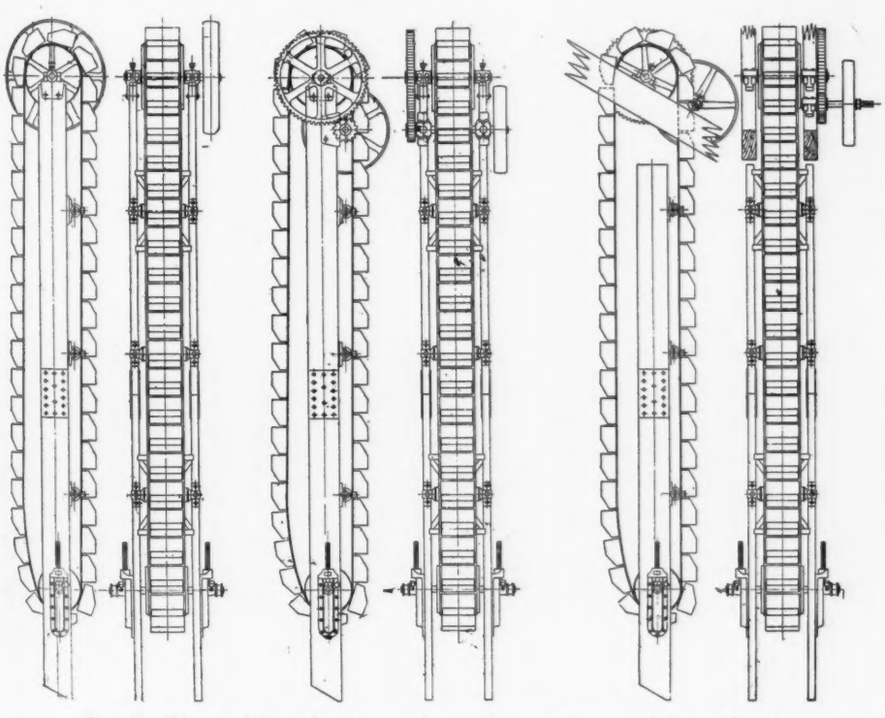


*Fig. 6. Direct drive elevator and two forms of gear driven elevators of the belt and bucket type*

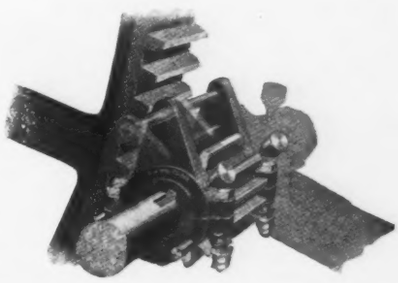


*Fig. 7. Device on elevator drive shaft to prevent reversal of bucket travel*

## Pumping Handbook

THE Novo Engine Co., Lansing, Mich., has recently brought out a well printed illustrated manual containing some useful information on pumps and pumping work. Ordinary and usual problems are discussed, accompanied by suitable illustrations and diagrams. Tables, rules and practical data are included in the new booklet.

# Handling Portland Cement in Bulk With a Pump Boat

## Manitowoc Portland Cement Company Has Unique Method for Great Lakes Transportation—Boat Equipped with Bag Packers

BULK cement carriers for service on the Great Lakes are not new, nor novel, but one named the "Daniel McCool" recently put into service by the Manitowoc Portland Cement Co., Manitowoc, Wis., is novel, and for the moment, at least, unique. It is the first vessel to load and unload its cargo by means of Fuller-Kinyon cement pumps. It is the second vessel, so far as we know equipped with a valve-bag packing plant. (The Huron Portland Cement Co. has a lake carrier equipped with a packing plant.) Thus, while cement is put aboard in bulk, it may be unloaded either in bulk or in bags.

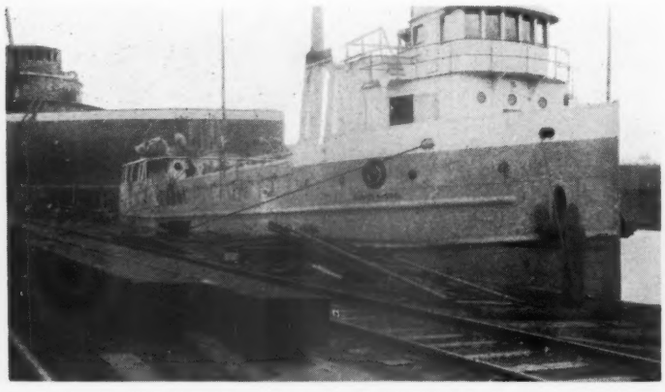
The "Daniel McCool" is a steel ship 156 ft. long, 33 ft. 9 in. beam, with a draft under full load of about 13 ft. It was built by the Manitowoc Shipbuilding Corp. especially for this service. The bin space, or cargo capacity, is 4000 bbl. of cement. Power for driving the boat and for its mechanical equipment is supplied by two 240-hp. Fairbanks-Morse Diesel engines. These are direct connected to twin propellers and to 200-kva. generators. The engines are connected to the propellers through clutch couplings and on the forward end each engine is direct connected through solid couplings to the alternating-current generators. As no appreciable amount of current is used while the ship is underway, the alternators operate at all times with the engines. When the vessel is at the dock with the cargo machinery in operation, the clutch couplings with the propellers are disengaged, and the electric current made is used for operating the unloading machinery. This equipment is all in the engine room aft together with two 350-cu. ft., 100-lb. (actual delivery) single-stage air compressors. At the same end of the boat are the crew's quarters, cook's galley, shower baths, washrooms, etc.

There is also a Fairbanks-Morse 4-cylinder 36-kw. Diesel engine generating set, and one 2-cylinder 18-kw. Diesel engine generating set. Both of these units are used for lighting and general service. These auxiliary units also supply current for operating the fire, ballast room, bilge and oil transfer pumps, which are all direct current.

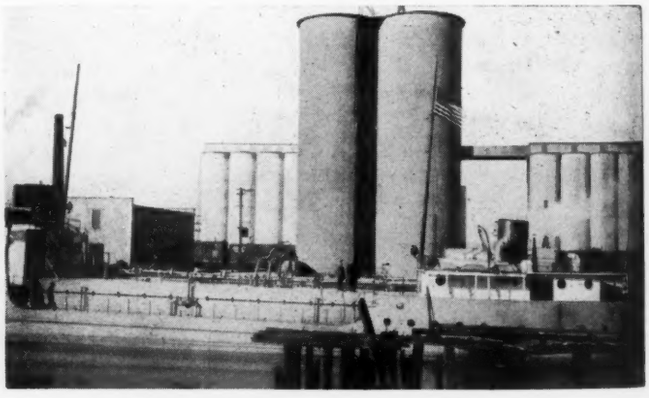
### *Cargo Space*

At the forward end of the boat, just back of the pilot house, is a packing room with two 3-tube Bates valve packers, with a belt conveyor which can be extended over the side of the boat to discharge cement in bags.

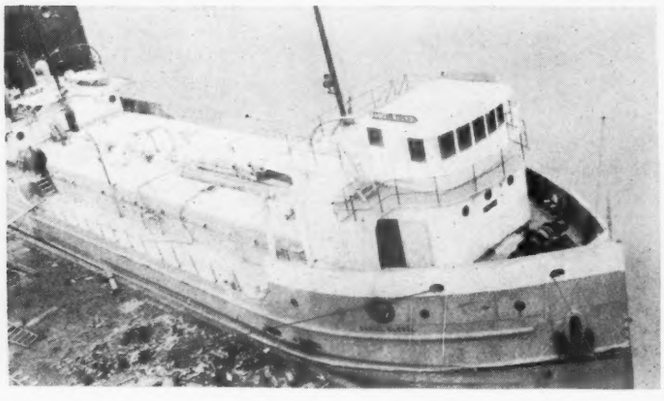
The cargo space consists of six bins, or compartments of the hull, three on the starboard side, and three on the port side. Two bins on each side have five outlets, and each is fitted with a Star feeder; the third bin on each side has six outlets, fitted in the same way. These Star feeders discharge through short spouts into 14-in. screw con-



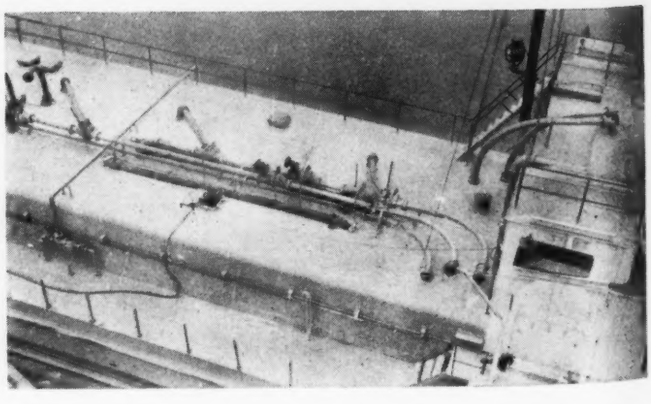
*The "Daniel McCool," a portland cement carrier at Manitowoc dock*



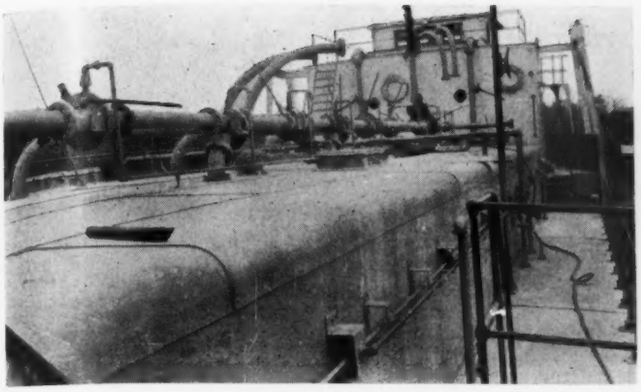
*The Manitowoc Portland Cement Co. plant in the background*



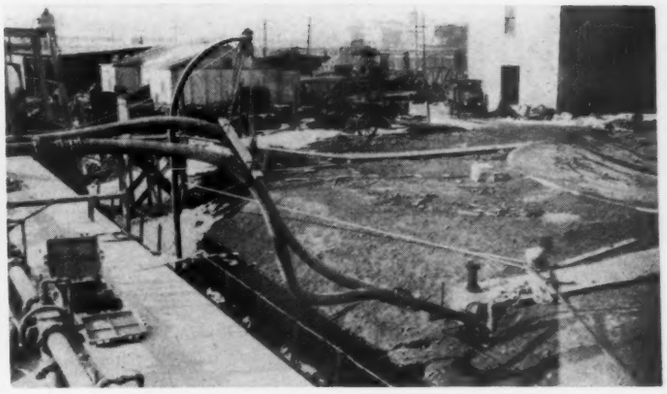
*Looking down on the deck of the "Daniel McCool"*



*Pipe lines and connections at right for receiving cargo*



*Cement bins and piping of the "Daniel McCool"*



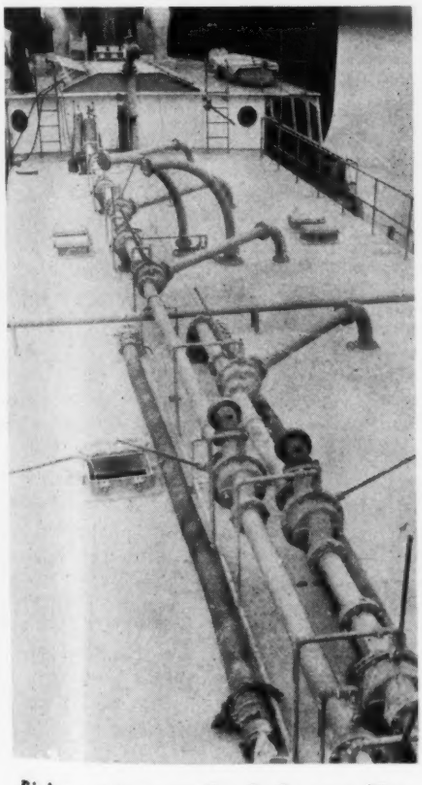
*Flexible connections attached to shore ends*

veyors, one conveyor being under each row of bins. All of these Star feeders are equipped with clutches, so that the number being used is under the control of the operator.

### *Cement Pump Equipment*

The travel of the cement in each screw is toward the aft end of the boat to the feeder of an 8-in. Type B Fuller-Kinyon pump, one under each screw conveyor, with the center line of the pump parallel to the center line of the conveyor. Each pump is direct-connected through a flexible coupling to a 75-hp. squirrel cage induction motor running at 900 r.p.m. The pumps discharge to two 5-in. conveying conduits, or pipes, which rise about the center of the boat.

From these pipe lines on the boat there is a flexible metal hose connection to shore.

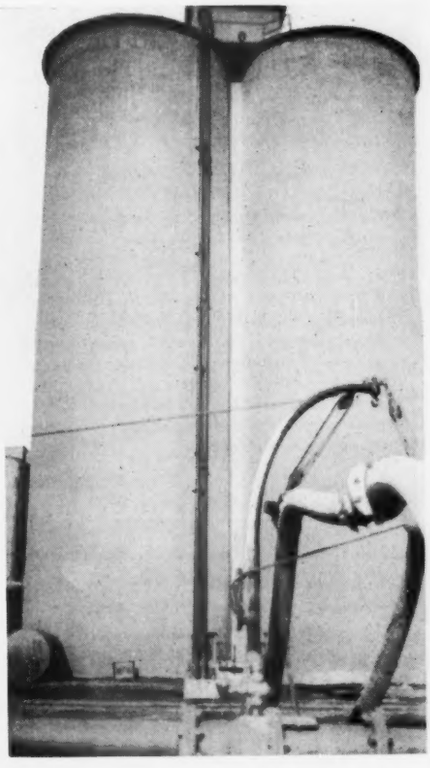


*Piping system on the deck, over bins of the "Daniel McCool"*

The shore end is connected to permanent pipe lines connecting with silos or other storage facilities. Such silos for packing the cement for local trade have been established at Milwaukee and Chicago. The total length of the unloading pipe lines in these cases is about 250 ft. in each case.

### *Loading the Boat*

Loading the boat at the Manitowoc plant is taken care of by two 8-in. Fuller-Kinyon pumps, each direct-connected through flexible couplings to 150-hp. 900-r.p.m. squirrel cage induction motors in the plant. The cement is fed to these pumps through collector



*Davit for handling flexible pipe on board the "Daniel McCool"*

screws underneath the silos and small hoppers over the pumps. The cement from these pumps is discharged through 5-in. conduits, or pipe lines, one for each pump.

*Screened open hatches of the hold, or bins of the "Daniel McCool"*

These extend underground to the water's edge at the wharf.

Flexible metal hose sections, which are part of the boat's equipment, are suspended by a davit on the boat and connected with the shore ends of the pipe lines. The inboard ends of the flexible pipe sections are connected with permanent distributing lines over the deck of the boat. The connections are all made by bolts through pipe flanges, with gaskets between. The total conveying distance, through which the cement is pumped, at the loading end is about 475 ft. While loading the hatches are open; they are screened with burlap.

The two Fuller-Kinyon pumps on the boat are so connected as to deliver the cement to the two bins over the bag packers when desired. These pumps have an unloading capacity rated at 350 bbl. per hour, and the plant loading pumps 500 bbl. per hour.

# Fiftieth Anniversary of the German Association of Portland Cement Manufacturers

## Introduction for Rock Products Readers

By DR. CURT PLATZMANN

THE Association of German Portland Cement Manufacturers celebrated its fiftieth anniversay on August 28 to 31, in Berlin. Beginning with a reception evening at the restaurant of the Zoological Garden, the actual celebration took place on August 29 in the main hall of the former Prussian House of Lords. The co-operation of the Philharmonic Orchestra was secured. The commemoration address was made by Dr. Bucher and in accordance with the traditions of the Association, addresses were made at the same place on the following day by Professor Burchartz of the Materials Testing Department, Dr. Haegermann, Karlshorst, Professor Nacken, Frankfurt a.M., Professor Gehler, Dresden, and finally, by Dr. Riepert, the president of the German Cement Confederation, who spoke on the scientific development of the German cement industry. The history of the Association is that of the industry itself, as all companies almost without exception have belonged to it since its foundation. The fact that Germany today maintains second place in the world production of cement, while up to 1904 it was altogether ahead of all countries, is a proof of the high quality of German products. This year will see the pre-war figure of about 7½ million tons exceeded for the first time.

In these days, when so much is said about standardization and rationalization, we may well be reminded that the Association published its first standards as early as 1878 to insure uniform product and uniform testing procedure. These standards became a guide in many a country, and it is mainly due to the early establishment of a quality control that the German cement industry owes its growth and expansion.

A scientific and business session was also held, Professor Abrams of the International Cement Corp. of New York being one of the notable guests. Another social gathering was held at the Hotel Esplanade and yet another in Kroll's establishment. The convention closed with a trip to the laboratory in Karlshorst, which has operated for over 25 years and has recently been greatly enlarged.

The achievements of the Association in the scientific field are immense. However, their reaction on the economic development of the cement industry is almost of greater moment. In spite of the disastrous effect of the war and inflation with consequent compulsory operation, coal shortage, eternal strikes and unrest, the industry has not only maintained itself, but has created during these difficult years an up-to-date operation mark, so that today it stands ready to compete in the world markets. The part played by the German cement industry during the past year is evident when one considers that England, the country where portland cement was originated, produced not much more than 3½ million tons, France about 2½ million tons, while the 110 German plants produced during the same year about 6 million tons.

### *Editors' Note*

***FIFTY years ago 23 cement manufacturers of Germany formed an association to "unite under one direction the testing and research problems of portland cement manufacture." It was called the German Association of Portland Cement Manufacturers and under the capable leadership of high-calibre men developed to its present position as the foremost cement research institution in all Europe. It is largely due to this association that the German portland cement industry has advanced to its efficient state and the entire world has also been a gainer, for many of the technical papers emanating from the laboratories of the association have been translated and reprinted in nearly all the civilized languages.***

***The association's fiftieth anniversary, celebrated recently at Berlin, was the occasion for a special edition of the German journal "Zement," from which the abstracts given herewith are taken. The authors are recognized as leading authorities of their respective countries and also have gained considerable prominence in other places. Some of the more important of these papers will be published in full in future issues of ROCK PRODUCTS.***

***—The Editors.***

## Definition of Portland Cement

By DR. G. HAEGERMANN

AN exact definition of portland cement should give:

1. Data of the chemical structure (constitution) of the individual constituents, and limit values of their relative quantities.

2. Data of their characteristic properties.

Many attempts were made to clear these two points, von Glasenapp giving the following description of the petrography of portland cement clinker:

A. Isomorphous mixtures:
   1. Alite. 2. Slag. 3. Glass.

B. Mixed crystals:
   1. Belite. 2. Celite.

Of these, alite was recognized to be the most important constituent and all further studies were devoted mainly to the establishment of its properties.

It is evident that a scientific definition of portland cement cannot be given at this time, nor can it be expected in the very near future. In the meantime, practical conditions forcing a definition, the exact data of the chemical structure of clinker were abandoned and in their place was introduced a description of the methods leading to the formation of its mineral structure. At present portland cement must conform to the definition of the standards and must satisfy their minimum requirements. A cement not satisfying the above cannot be called a portland cement. The standards read:

"Portland cement is a hydraulic cementing material, containing not less than 1.7 parts by weight of lime (CaO) to 1 part by weight of soluble silica ($SiO_2$) + alumina ($Al_2O_3$) + iron oxide ($Fe_2O_3$), manufactured through fine grinding and intimate mixing of the raw materials, calcination at least to the sintering point, and subsequent pulverizing. Portland cement shall contain not more than 3% admixtures added for special purposes.

"The magnesia content shall not be greater than 5%; the sulphuric anhydride content not greater than 2.5% in ignited portland cement.

"A hydraulic cementing material is a powdered material, which, when mixed with water to a paste (mortar), has the property of setting (congealing) in air and in water after a certain period of time and of hardening (gaining in strength)."

The ratio $\frac{CaO}{SiO_2 + Al_2O_3 + Fe_2O_3}$ is generally designated as the "hydraulic modulus" and was first introduced by Michaelis. No upper limit is set for the lime content. Only the soluble silica, alumina and iron oxide enter the equation. The relative quan-

tities of the latter may vary, as long as their sum bears the ratio of 1 to 1.7 parts by weight of lime.

Thus alumina cement is not a portland cement, as its hydraulic modulus is lower than 1.7, while the so-called Erzzement and the white cements lie within the limits of portland cement.

The requirements of "fine grinding and intimate mixing" have given portland cement its advantage over other cements. It is here defined as an artificial mixture. A further clause provides that "similar products, manufactured from natural rock, shall be designated as 'natural cements'."

Objections have been raised to the latter clause, arguing that varieties of rock are found in nature which, when calcined, yield a product of identical mineral structure and properties. However, rock of this description is very rarely found in quantities warranting its use on a commercial scale. Therefore, to protect the portland cement manufacturers, such terms as "natural portland cement" and "Naturportland zement" were rejected, all cements calcined from natural rock being called uniformly "natural cements."

The terms "fine grinding and intimate mixing" cover both the wet and the dry process and a variety of raw materials. Fluxing materials, feldspar, or others, may be added as long as they do not upset the desired ratio.

The requirement of calcination at least to the sintering point distinguishes portland cement from lime, which is obtained at temperatures below this point.

The clinker is ground to a fineness leaving not more than 5% retained on the 900-mesh sieve. Admixtures added to the cement are limited to 3% to prevent adulteration of cement to increase its weight. The magnesia content is limited on account of its tendency to produce unsoundness. This is also true of the $SO_3$ content.

## The Laboratory in the German Cement Industry

By DR. K. GOSLICH

As early as 1877, 18 German cement companies recognizing the importance of a rigid control of the raw materials formed an organization for scientific research and control. It was the task of plant laboratories to maintain the empirically established relation between silica and alumina on one hand and calcium carbonate on the other. This was no simple task as the equipment of the laboratories was most elementary. The good old Berzelius alcohol lamp had to be used instead of a Bunsen burner; the chemist made most of his own apparatus.

It was gradually recognized that analytical methods should be supplemented by physical-chemical methods. Thus, the up-to-date silicate laboratory contains, in addition to the usual analytical apparatus, X-ray machines, microscopes, electric devices for the testing of electrical conductivity, and other equipment.

As often happens, the chemical laboratory does not meet with sufficient recognition, yet it is without doubt the most important part of a cement plant, as the ratio of lime and other materials is checked here constantly. All further phases of manufacture such as calcination and grinding could not correct the effect of initial faulty composition.

The early physical laboratory began with testing the tensile strength of large figure eight-shaped specimens of 10.4 sq. cm. smallest cross section by clamping them in a clamp attached to the ceiling and increasing the weight in a scale attached to another clamp until the specimen broke and the entire apparatus fell to the ground with a crash. From this crude stage the physical laboratory has progressed to its present high state where testing procedure has been extended to many other properties of cement and the importance of compressive strength of mortar specimens recognized.

## Clinker Research

By DR. WALTER DYCKERHOFF

The publication of the author's researches on the constitution of portland cement clinker brought about a lively discussion. To his knowledge a systematic checking of his results was carried out only by the Portland Cement Association Fellowship at the U. S. Bureau of Standards in Washington. A thorough study of the lime-silica-alumina system was made. Nevertheless, the question of what is portland cement is not as yet solved. American scientists tend to agree with Rankin's carefully worked out theoretical conclusions on the constitution of portland cement clinker. Deducing his results on the basis of conditions of equilibrium, he maintains that clinker is made up of tricalcium silicate, bicalcium silicate and tricalcium aluminate. It has since become apparent that sintering in an industrial kiln does not result in an equalibrium, that tricalcium silicate, though having properties of hydraulic hardening, is unsound, that bicalcium silicate has no hydraulic properties and that tricalcium aluminate is not found in the clinker.

The existence of the compound $8\,CaO \cdot 2SiO_2 \cdot Al_2O_3$, the so-called Janeckeite, was also tested. The author was very graciously accorded the facilities of the Bureau of Standards for co-operation in this work. The best equipment was placed at his disposal.

These tests revealed that the phase assumed to exist as a ternary compound in a state of equilibrium did not actually maintain a state of equilibrium, but was unstable similar to other silicate melts. It was possible to carry the experiments to a point approaching equilibrium. In doing this, the samples lost the homogeneous nature of the original melts and showed distinctly two different anisotropic phases in the glass, these phases being easily identified by means of the microscope as bi- and tricalcium silicate. The x-ray photographs of samples subjected to very high temperatures failed to establish the setting in of stability.

The actual course of the reaction appears to take place as follows: $8CaO + 2SiO + Al_2O_3 = 2\,(3CaO \cdot SiO_2) +$ glass. Thus the compound $8CaO \cdot 2SiO_2 \cdot Al_2O_3$ does not exist.

Clinker research has abandoned the path of purely chemical methods and greatly profited by the introduction of mineralogical petrographic methods and of x-rays.

The determination of free lime in clinker, so long a subject of controversy, can now be easily established by White's method. Its quantity can be found by titrating a sample of cement mixed with absolute alcohol and glycerine with the addition of a few drops of phenolphtalein, with an alcoholic solution of ammonium acetate.

It is indeed deplorable that many results obtained with now antiquated methods are being adhered to stubbornly, disregarding the light thrown on the subject by new facilities.

### *Results Established*

So much has been established thus far: the lime silicates are the carriers of the hydraulic properties of cement. Bicalcium-silicate, formed first, takes up other substances, namely, lime, in solid solution in the course of sintering. The bicalcium silicate crystals found in the clinker, therefore, differ somewhat from the crystals of the pure compound, namely, by a smaller angle of the optic axes and lower double refraction. The effect of the melt is to transform part of the bicalcium silicate into tricalcium-silicate. This transformation occurs very slowly; the quantities of tricalcium silicate varying over a wide range. However, this quantity is always lower than that expected from the analysis. $3CaO \cdot Al_2O_3$ does not occur in the clinker. It appears, therefore, that the remainder of the melt is made up of crystallized ternary compounds of $CaO \cdot Al_2O_3$ and $Fe_2O_3$.

The names "alite," "belite," etc., should be replaced by the terms bicalcium silicate and tricalcium silicate, to which are added the products of the melt, not yet definitely identified.

Further research should concentrate on the study of the reactions of these clinker minerals. Great benefit will then be derived for the practical processes. Thus far, we have no way of measuring the quantity of hydraulically active constituents of the clinker. Yet a knowledge of this would enable us to achieve a more efficient production of a maximum hydraulic value. This can only be accomplished by close co-operation.

## Colloid Chemical Reactions of Alumina Cement Mortar

By LEOPOLD JESSER,
Vienna

THE method elaborated by van Bemmelen for the investigation of the drying phenomena of silica gel was used. Starting out with water saturated mortars, their drying is effected gradually in air of constant tension, also over salt solutions or diluted sulphuric acid of certain concentration, up to constant weight. The samples are then gradually exposed to air of higher tension and finally to curing in steam saturated air. Diagrams are plotted with tensions as ordinates and quantities and volumes of water brought to a state of equilibrium, as abscissae. These charts are commonly designated as "adsorption isotherms."

Tests of portland cement mortar established that every degree of drying, produced at room temperature or higher temperatures (observations up to 80 deg. C), corresponds to an approximate condition of equilibrium, which is manifest by a certain quantity of water adsorbed in the gel and a certain volume. These volume changes are partly irreversible. Increased intensity of drying increases the irreversible changes of the water and of the volume.

Further tests of portland and alumina cements were made out of contact with the moisture of the air. It was established that the water contained in the pores of the mortar becomes adsorbed in the cement gel soon after hardening sets in. Another important conclusion was that the water found in the cement gel immediately after hardening bears a definite relation to the cement-water ratio of the mortar after mixing. The quantities of water, found in diffierent gels at the same drying tensions and temperatures, stand in the same relation to each other as the water content to the cement of the mortar before hardening sets in. This was also observed by van Bemmelen.

### *Coagulation Theory*

The original relation of the cement congealing to the congealing of the dried silica gel is explained by the coagulation theory expounded by Wiegner and von Smoluchovski. The surfaces of the gel microns are the carriers of a potential free energy. It appears, on one hand, as kinetic energy of the hydrosols in the Brownian movement of the gel microns; on the other hand, the microns in an isoelectric state attract each other. A combining of the gel microns to form a stiff structure is possible only, when the particles become so heaped upon each other, that each one falls into the sphere of attraction of the other. This condition is reached for silica gel by the evaporation of water from the hydrogel. In cement mortars, however, where the water available for gel formation is limited by the pore volume, the accumulation of gel microns sufficient to produce congealing is brought about by the continuous gel formation from the cement. Hardening therefore, is limited by a certain concentration of microns. It is evident from the above that the concentration required for the congealing of silica and cement gels varies over a wide range, yet in spite of these differences in the concentration, all available water is adsorbed. The causes of this possible variation of the water contained in the congealed gels have not as yet received explanation.

At a certain point the silica-hydrogel is converted into a skeleton micron structure with about 50% fine pores. Alumina cement gel is entirely homogeneous immediately after hardening. Yet in drying, particularly when drying at high temperatures, a structure is developed which contains up to 13% pores even in a steam saturated state. The silica gel is stable at the point of conversion and undergoes changes only when heated to high temperatures. The hardened alumina cement, however, is unstable even during drying. The transition to the stable state seems to take place with great shrinkage and consequent development of pores. This inner shrinkage results in a skeleton similar to that of the silica gel. This explains the casual relation of the water tightness and soundness with the stability of the mortar on one hand, and with the micron concentration at the time of hardening and the cement-water ratio in the mortar, on the other.

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## Effect of the Temperature of Hardening on the Strength of Alumina Cement Mortar

By A. F. ROSCHER LUND
Trondheim, Norway

THE tests of Lafarge (aluminous cement) mortar cured at higher temperatures (steam cured) have not as yet been completed, the final results being expected in two years. Nevertheless, the series appears to be particularly instructive as it throws some light on the considerable rise in temperature produced during the hardening of alumina cements and concrete made from these cements. Considerable temperature differences thus result between the concrete and its surroundings as well as between the different parts of the structure.

The cement used corresponded to the Norwegian specifications, which are very similar to the German. A good, uniform sand with a fineness modulus of 4.07 and a void percentage of 38.1 was selected.

Tensile strength specimens were made. The molds were removed immediately upon hardening, i.e., about 25 minutes after filling the molds, and the specimens cured for 24 hours in moist air (box). For specimens of low temperature (7.5 deg., 17.5 deg., 25 deg.) the outside temperature was the same; for specimens of higher temperatures (37 deg., 62 deg., 85 deg.) cooled steam was admitted to keep the temperature as uniform as possible. Compression cylinders of 8.5 sq. cm. cross section were also made. While the tensile specimens were kept at a uniform temperature, the compression specimens were heated gradually (3 to 8 hours), the conditions thus tending to reproduce those of actual practice.

Topographic charts of tensile and compressive strength were plotted. The results were as follows:

a. Tensile tests. Specimens allowed to harden for 24 hours in steam over water at 88 deg. yielded the following strengths: At 24 hours, 43.0 kg. per sq. cm.; at 7 days upon subsequent water curing at 16 deg., 45.9 kg. per sq. cm.; at 28 days, 46.6 kg. per sq. cm. The corresponding values for hardening over water at 61 deg. are: At 24 hours, 418 kg. per sq. cm.; at 7 days, 43.0 kg. per sq. cm.; at 28 days, 47.5 kg. per sq. cm.

b. Compression tests show distinctly that rapid heating is less detrimental to hardening than slow heating.

In general, these results agree with the conclusions of Wernekke published in *Zement*, **48**, 1926.

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## The Present Status of Portland Cement Research and the Possibilities of Manufacture of High Test Cements

By P. H. BATES
U. S. Bureau of Standards, Washington, D. C.

THE fiftieth anniversary of the Association of German Portland Cement Manufacturers comes at a time when the manufacture and uses of portland cement are the subject of much discussion. The wide possibilities of its use as concrete and the introduction of high alumina cement, gaining extraordinary strength in a very short time, have opened new fields for this product.

While high strength cements are manufactured in Europe, the efforts in the United States centered on improving the strength of portland cement has led to extensive studies of this subject.

Though portland cement has been manufactured on a commercial scale for 100 years, little is known as yet of its true nature. Thus its strength has been accepted as a criterion, though insufficient proof is available that it is a true indication of the other properties of cement. In brief, there is no unity of opinion concerning the constituents of cement and their reaction with water.

Nevertheless, certain facts have been generally established. Thus a study of cement clinkers reveals the same constituents though different scientists prefer to call them by different names. It is generally agreed that a cement with high lime content is the best carrier of the quick setting and hardening properties. The temperature and duration of calcination in our present kilns limit the lime content of cement.

By reducing the silica content without changing that of alumina and iron oxide, a

considerable increase of the desired constituent is effected. Thus, assuming the composition of this constituent to be $3CaO{\cdot}OSiO_2$, and the content of iron oxide and alumina to remain constant, the reduction of the silica content by 1% results in a rise of the lime content of 11%. If two cements, both containing 8% $Al_2O_3$ in the form of $3CaO{\cdot}Al_2O_3$, contain respectively 22% $SiO_2$ and 70% CaO and 23% $SiO_2$ and 69% CaO, the former must have 65.1% $3CaO{\cdot}SiO_2$, while the latter only 53.3% of same.

### *Materials Increasing Lime Percentage*

Iron oxide replacing part of the alumina, would increase the desired percentage, also reducing the difficulty of calcination. Should our kilns be adapted for this purpose, a lime content as high as 71% could be obtained.

Magnesia is another constituent which considerably furthers the formation of a high lime product at low temperatures. However, the presence of magnesia in cement has always been the source of grave doubts and is limited by all specifications. Recent tests of magnesia compounds in cement, carried out at the Bureau of Standards, have revealed the mineral monticellite, $MgO{\cdot}CaO{\cdot}SiO_2$, formed in the presence of 7.5% magnesia, and spinell $MgO{\cdot}Al_2O_3$, formed with 10% magnesia.

Iron oxide, which is capable of increasing the high-lime constituents, has been studied relatively little. Its content is limited by practical difficulties, such as the formation of rings in the kiln, etc.

### *High-Test Cements*

There remains the possibility of producing high-test cements from entirely different materials. The restriction here lies in an adequate supply of such materials. Magnesia oxy-chloride, zinc oxy-phosphate, aluminum silicate-metaphosphate all produce quick-hardening cements and could be used in a great many places, where cement is used now. On account of insufficient supply, however, they command high prices, which eliminate them from competition with cement, except for special purposes. The limited supply of bauxite is thus responsible for the high price of alumina cement.

The Bureau of Standards has recently tested LeChatelier's work with barium silicates and established that $2BaA{\cdot}SiO_2$ possesses distinctly hydraulic properties.

The raising of the quality of cement should be searched for continuously. Hardening is known to take place slowly and incompletely. The discovery of a catalyzing agent accelerating this reaction with water, would be of great benefit. Calcium chloride has its limitations in this respect.

There is no doubt, that portland cement can be further improved. It must be emphasized in this connection that the generally accepted testing procedure leaves much to be desired and that the improvement of the quality of portland cement, as well as the possibility of manufacturing special high test cements, will depend on the development of specific tests of cement.

## Scientific Investigations of the American Portland Cement Industry

By F. R. McMILLAN

Director, Research Laboratory, Portland Cement Association

RESEARCH commands an important place in many industries in the United States, laboratories being maintained by the General Electric Co., the Eastman Kodak Co., the General Motors Corp. and many other internationally known concerns.

The manufacture of portland cement in the United States began in 1872, but it was only in 1914 that the Portland Cement Association entered into an agreement with the Lewis Institute for the maintenance of a research laboratory. Four years later the first publication was released, 100,000 tests having been made in the meantime.

In June, 1926, the laboratory separated from the Lewis Institute and was reinstalled in the new Portland Cement Association building, where it occupies the basement, the first floor and part of the second floor.

### *Outstanding Achievements*

The first outstanding achievement of the laboratory was the introduction of the water-cement ratio. During its 10 years of activity more than 500,000 tests were made, including the making of 300,000 concrete and mortar specimens. The testing program now continues with an average number of 50,000 specimens a year. Seventeen bulletins were published by the laboratory. These were supplemented by a large number of articles and papers. The investigations of the laboratory have covered almost every field of concrete and are available in the form of bulletins.

Unusual facilities are offered by the new building. The basement serves for the storage of concrete materials and for the making of specimens. It also contains a cement testing room and a moist room for the curing of specimens.

The large testing laboratory, the physical laboratory and the machine shop are located on the first floor. The testing laboratory includes a 300,000 lb. Universal testing machine with motor drive, a 200,000 lb. Universal machine and a 200,000 lb. hydraulic press. The chemical laboratory on the second floor is particularly well equipped for analytical work on concrete.

Of interest is the study of cement colors and their resistance to weathering which is now being conducted by the chemical laboratory. Hundreds of specimens were exposed outdoors for this purpose. The Munsell system of recording colors is being used. The series is far from completed as exposure for long periods of time is being studied.

Considerable work is done at the laboratory in connection with volume expansion of concrete and mortar, their causes, effect and methods of control. A fellowship at the U. S. Bureau of Standards is making special investigation of the constitution of portland cement. Its definition is believed to be of great benefit for the uses of cement and concrete. The laboratory is making an effort to cooperate with other organizations interested in the study of concrete.

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## Technical Progress in Cement in England the Last 50 Years

By A. C. DAVIS

ALTHOUGH cement has been manufactured in England for over 100 years, the last 10 years have brought about greater progress than all the achievements of the past. The rotary kiln was invented in England 40 years ago and has now largely replaced the other types. Cement mills have undergone great engineering changes. Storage of cement in silos and automatic packing was introduced within the last decade and recently. Turbogenerators with electric drive have replaced other machinery for the generating of power.

The condition of the workmen has improved tremendously, the 12-hour shift being supplanted by 8 hours, a week's vacation being accorded to every employe and special pay being the rule for overtime work. Thus co-operation of employer and employe has been secured.

The quality of the product has changed considerably within the last 50 years. This came about chiefly through the adoption of uniform standards in 1904. The portland cement of recent years differs from the product of only a few years ago by higher tensile and compressive strength, absolute soundness, greater fineness, and the possibility of obtaining better concrete with less cement.

The cement plants underwent a regular revolution as a result of adoption of standards and are now capable of producing large outputs of a quality product undreamed of before.

Tremendous progress was made in the strength properties of cement, the values for neat cement of 23 years ago now being the rule for 1:3 mortar. The residue of 2.5 and 10% retained respectively on the 400 and 900-mesh sieves (per sq. cm.), as specified in 1905, is now seldom exceeded on the 4900-mesh sieve. The new English specifications of 1925 require not more than 10% retained on the 4900-mesh sieve.

The rapid-hardening portland cement is an achievement of the last few years. Its use permits heavy traffic to be resumed over surfaces laid 12 hours before. This cement is a real portland cement with a somewhat higher lime content. Special care is given to the measuring and mixing of the raw materials and its calcination also requires carefulness and lasts longer. The hard clinker produces greater wear of the grinding machinery.

The alumina cement is not a portland cement and is manufactured from imported bauxite, thus commanding a higher price.

This cement reaches the strength of portland cement at 3 months during the first 24 hours. Contrary to the high rapid-hardening portland cement, it acquires practically all of its strength during the first 24 hours, showing but little subsequent gain in strength. It is particularly adapted for work exposed to tidal action, repairs between tracks, foundations and concrete columns.

Research is now carried on in England to obtain an alumina cement hardening even more rapidly, one which after four hours would acquire a compressive strength of 2750 lb. per sq. in.

## Classification of Cements in Sweden

By W. DE SHARENGRAD, Malmö, Sweden

THE cement quality requirements of the 1910 Swedish specifications until recently in use were recently amended to allow the distinction of three classes of cements: Portland cement class B, portland cement class A, and special portland cement. Portland cement class B conforms to the requirements of the old specifications. Class A commands higher strength requirements. Special portland cements are not only distinguished by higher strength requirements, but have, in addition, the characteristics of high-strength cements and possess the property of early hardening.

The following table illustrates these requirements:

CLASSIFICATION OF CEMENTS IN SWEDEN

| Portland cement† | Compressive strength—kg./sq.cm. 2 days water curing[1] | 7 days water curing[2] | 28 days water curing[3] | 28 days water and air curing[4] | Tensile strength—kg./sq.cm. 2 days water curing[1] | 7 days water curing[2] | 28 days water curing[3] |
|---|---|---|---|---|---|---|---|
| Class B | ..... | ..... | 200 | 250 | ..... | 14 | 20 |
| Class A | ..... | 250 | ..... | 400 | ..... | 20 | 30 |
| Special | 225 | 350 | ..... | ..... | 20 | 30 | ..... |

[1]Cured 1 day in moist air and 1 day in water.
[2]Cured 1 day in moist air and 6 days in water.
[3]Cured 1 day in moist air and 27 days in water.
[4]Cured 1 day in moist air and 6 days in water and 21 days in air.
Note: 1 kg./cm.² = 14.2 lb. per sq. in.

## The Portland Cement Plant of the Future

By CARL NASKE, Charlottenburg

THIS paper is not intended as a dream after the manner of Jules Verne, but merely a description of the plant of the future, should the present tendencies lead to the desired results.

The center of the plant is naturally the kiln—the rotary or the automatic shaft kiln. To remove the weak points of the present kilns it soon becomes evident that these weak points are inherent in the nature of the kilns and cannot be eliminated without doing away with the kilns themselves.

This is not a new thought. A discussion of the reason for the flue gas temperature of the rotary kiln being so much higher than that of the shaft kiln brought about the statement that "the flue gases of the shaft kiln come into intimate contact with the charge, while in the rotary kiln they pass over the charge without penetrating it. The charge which is being preheated should be brought into intimate contact with the hot gases."

Quoting another source: "the performance of the rotary kiln is based on a blast inside the kiln, which should not touch the kiln lining, i. e., should be directed axially, to insure sufficiently long life of the lining. The charge thus becomes heated only indirectly through the hot gases and to some extent through radiation. . . ." Alterations of the dimensions or speed of rotation of the kiln would hardly result in improvement.

### *Shaft Kiln Advantages*

It is agreed that the shaft kiln has certain advantages over the rotary kiln. It is also a fact that under present conditions the charge passes through the kiln, which is often extended to ungodly lengths, during as much as three hours, this period to be followed by seven to eight hours stewing in the cooler shaft, before it ever gets to see daylight. The necessity of such a procedure is a matter of doubt to myself for I believe the stopwatch should be the constant guide and advisor of every plant manager and that the slogan to be adopted is: "Acceleration, cost reduction and increased production."

The direction in which this is to be achieved is indicated by the requirement quoted above of "intimate contact of the charge with the gaseous flames" i. e., a finely ground mix, not briquets as in the shaft kiln, must be brought to the sintering point inside the space occupied by the flames, not outside of the latter, as in the rotary.

This may be accomplished by injecting the fuel (pulverized coal, gas or oil) together with the charge or separately, as the case may be, into a shaft, whose inner temperature is high enough to insure clinker formation under any circumstances. This shaft should be insulated completely.

### *The Ideal Cement Mill*

The ideal kiln is thus an automatic shaft kiln in the widest sense of the term and has many advantages such as the concentration of burning in a single shaft of moderate dimensions even for large outputs. The burning zone need only be large enough to allow free play to the flame, as the reduction and clinkering of the mix will take place here in as many minutes as it is now taking hours. The heat of the flue gases will be utilized completely for power generation, drying of the fuel and raw materials. The heat of the clinker will be used for the preheating of the air. Finally, there will be the advantage of complete absence of moving parts reduced to two exhaustors (to the great disappointment of machine companies), small requirements of space and low cost of installation.

The raw mix will be forced by means of exhaustors into cyclone-type storage silos, discharged automatically by compressed air. The cement mill will be provided with air separator and a pneumatically regulated feed apparatus, which will permit adjustment for any desired fineness. The raw materials will be stored in one common storage place which will also receive clinker, coal and gypsum. The plant will be equipped with up-to-date dust collecting devices. Transmissions will be eliminated, each machine being operated individually and being provided with speed reducers. This will do away with belts and a great deal of oiling with consequent saving of oil and greater cleanliness as well as greater safety. The labor will be reduced to a minimum, the largest plants needing no more than a dozen men.

It would be futile to attempt to state at what time in the future or with what changes this plan will go into effect.

## Oil Shale Ashes for Cement Production

By DR. K. KILLIG

THE successful use of oil shale ashes for cement production in localities where clay is scarce is based on the following advantages: elimination of crushing and grinding and of the difficult process of drying clay. The oil shale ashes leave the furnace in a dry condition, are easily broken up and, if obtained from old heaps, can be dried with comparative ease.

The oil shale ashes of Oeland have been used in the cement industry for some time and have given an opportunity to study certain difficulties which arise wherever they are used.

The main difficulty consists in the variation of their composition. In passing from less soluble to more soluble shale ashes, an error creeps in the chemical laboratory, unless account is taken of this fact. In dissolving the raw mix in HCl during the titrimetric determination, a greater quantity of the acid is used up. The $CaCO_3$ content thus appears higher than it is in reality. Consequently the raw mix has insufficient $CaCO_3$ and suffers through incorrect proportioning.

These conditions may be relieved by mixing different lots of oil shale ashes, storing them in large containers and introducing quick methods of checking the titrimetric determination by gravimetric means.

Care should be taken that the shale ashes used are burned completely and that large lumps do not contain an unburned core. The incompletely burned ashes introduce grave errors in the analyses, as their unburned organic constituents require considerable quantities of KOH during titration, the results of titration being greatly obscured by that.

Such errors can only be checked by gravimetric methods. The latter are the only ones to be used in the case of bituminous shale used in the cement industry, which by the way, is one of the last materials to which a cement producer will turn.

Insoluble CaO has also been encountered in oil shale ashes from lime kilns. Consequently, the latter have been rejected by the cement industry.

It must be admitted, that, while the oil shale ashes do away with some of the grinding and drying processes, they greatly increase the work in the laboratory. The decision, therefore, is one based on considerations of economy.

The coal shortage of some years ago placed great expectations on oil shale firing. This has largely been abandoned, wherever coal is now available, on account of the difficulty of a cheap method of disposal of the huge heaps of shale ashes. It seems that the cement industry may solve this difficulty by taking advantage of replacing clay by oil shales ashes.

## Producing Quality Concrete

By ROBERT OTZEN, Hanover

LARGE scale construction involving large expenditures has brought about a continuous effort to improve the quality of concrete as a building material. This should begin with the structure of the mortar mixture and should extend to cover the design of outer shapes of the structural members and the finishing of outside surfaces.

Concrete is an artificial stone of complicated structure. Nature has provided an abundance of rock varieties, from which one possessing sufficient compressive strength is to be selected. However all rocks have the disadvantage of low tensile and shearing strength, which vary within the range of 1/8 to 1/50 of the compressive strength. Thus concrete is in itself an improvement on nature.

### *Grading for Quality*

Concrete consists of cemented particles of rock. From a mineralogical standpoint the "cubic" form of particles is the best. For a long time general specifications of a wide range of sizes and a limit quantity of fines were considered satisfactory in practice. The resulting wide variation of quality led to studies, such as by Fuller, Herrmann and Graf. The correct grading yielding best quality concrete is now established, though some of the laws are not easily applicable in the field. Thus the ordinary run of gravel can now be "improved."

The scientific elaboration of these problems may be carried too far, as in practice the commercial point of view will prevail. Strength tests are the only measure of concrete quality. The cement content is an important factor in this connection. The practical problem will resolve itself into asking whether a mix of 1 part (by volume) of cement to n parts (by volume) of "improved" aggregate will be more economical, the quality being the same, than a mix of 1 part cement to (n+r) parts arbitrarily selected aggregate.

The third constituent is water which produces the physical chemical processes of hardening and affords a medium for the cement particles to surround the surfaces of the aggregate. No methods of improving the water have as yet been found, though its quantity and freedom from impurities have received adequate attention.

Continuous progress of the cement industry has recently introduced early high strength and rapid-hardening cements of unusual properties. It is important to keep in mind that the whole can be improved only by improving all of the constituents.

The lay mind does not ponder about the present possibility of building stone beam bridges of large spans any more than it did about the arches of the past. The low tensile strength of concrete has been corrected by the insertion of reinforcement. As the strength of concrete does not yet approach the high strength of ordinary commercial steel, no further requirements need be advanced with respect to the reinforcement. However, the constantly rising quality of concrete will undoubtedly tend to equalize this relation. Attention should also be paid to the method of working the concrete. The conflict between scientific methods and crude foreman's tactics is particularly acute here.

## Effect of Calcium Chloride on the Compressive Strength

By PROF. O. GRAF

EARLIER tests have shown that calcium chloride has an accelerating effect on the setting of portland cement, iron portland cement and slag cement. However, the effect of calicum chloride varies with different cements and may even become a retarding agent, when it is used in large amounts.

Thus far tests have dealt with the setting processes taking place at usual temperatures. The effect of low temperatures maintained during hardening on the compressive strength of concrete with calcium chloride admixtures was now studied. It appeared that calcium chloride counteracted the effect of low temperature. However, before using it, it is important to establish whether the cement without admixture attains the required strength under conditions to be expected. The quantity of the admixture should be increased for decreasing temperatures.

It is also important to bear in mind that calcium chloride admixtures influence some properties of cement other than the setting, such as expansion and contraction. Tests were made extending over a period of 224 days. It was found that expansion and contraction are considerably increased by calcium chloride admixtures.

## Duff A. Abrams' Trip Through Germany

By COUNT ALFRED KERSSENBROCK
Member, German Cement Confederation

***(Written expressly for Rock Products)***

FOLLOWING the celebration of the fiftieth anniversary of the Association of German Portland Cement Manufacturers, the American delegates, Duff A. Abrams of the International Cement Corp., New York, and L. T. Brownmiller of the Bureau of Standards, Washington, were taken on an inspection trip which included several German cement plants and machine companies. They were accompanied by Count A. Kerssenbrock of the German Cement Confederation.

The first plant inspected was the Thyssen cement mill at Rudersdorf, near Berlin, where the visitors were shown the new arrangement of the rotary kilns. They showed great interest in the high strength "Novo-Zement," specimens of which cured for long periods were on view. A visit was made to the laboratory and the sand-lime brick plant.

A trip to the Polysius Machine Co. in Dessau was planned for the next day. Kommerzienrat Polysius took the visitors first through the old plant and then through the new buildings. Mr. Abrams and Mr. Brownmiller evinced great interest in the manufacture of cement mill machinery and spent a good deal of time watching the processes, such as filing of rotary kiln rings, the making of bearings, rollers and screw conveyors, the assembling of mills, etc. They visited the experiment station, where new test mills, a new scale and several test kilns were being tested and built. Of special interest was a new though still very costly kiln lining which resists temperatures of over 2000 deg. C. This lining is tamped into place and not laid by masonry. The afternoon was spent visiting the Junker airplane works and the Dessau aviation field, where the planes "Europa" and "Bremen" were on view. There was also a model of an 80-passenger plane with cabins built in the wings.

On the following day the visitors went through the Amme-Giesecke-Konegen Machine Co. at Braunschweig. Director Bergen showed them plans of cement plants built by the company, such as the plan originally intended for Fort Worth, which later was used for the Southwestern Portland Cement Co.'s Osborn, Ohio, cement mill, and the plan of the plant in Lengerich, Westfalen. The numerous drawing rooms and offices of the company, laid out on a truly American plan, were also visited. Here the drawings and plans of cement mill machinery, such as crushers, kilns and pulverizers, form a special department. Another department is devoted to grain mill design. Of special interest were the large Titan crushers, as well as the new oiling system, invented by the company, with gear distributor and water cooling. The neatness of all the yards and shops about the plant was notable; each small plot of ground was

made into a flower bed or lawn. This order and neatness is maintained on a large scale as examples to the individual worker.

A short trip by rail took the guests to Hannover, where they were welcomed by Dr. Kneisel, president of the Association of Portland Cement Manufacturers, and Dr. Kühlemann, the director. At 2 o'clock they left in an auto for the Anderten locks, the largest inland locks of the continent, which are now under construction. The chief engineer demonstrated by means of a model the specially interesting features of the sluices and reservoirs. This was followed by a trip through the Misburg plant at Hannover, where there is a large Solo kiln and waste heat boiler installation. The harbor built by the cement companies in connection with the Mittelland canal, now partly in use, aroused the admiration of the visitors.

### *Cement Mill at Oberhausen*

They departed at 6 a. m. the next day to Oberhausen, Rheinland, to inspect the iron portland cement plant of the Good Hope steel mills and also their blast furnaces and rolling mills. The iron portland cement plant appeared novel to the visitors, as the use of blast furnace slag for cement is not common in America. The plant operates two Solo kilns built by the Polysius company, as well as two large Solo mills. The light greyish-brown color of the raw mix differs greatly from that of the usual cement mix and is due to the color of the slag used, which also varies in its composition and thus requires continuous control. The blast furnaces, the rolling mills and the casting departments were visited in the afternoon. Tracks laid on reinforced concrete ties came in for considerable attention. In the evening followed the departure for Münster, the location of the Lengerich plant of the Wicking company.

### *Visit to Wicking Institute*

The director's auto called for the visitors at 9 a. m. and took them along a concrete road leading to Lengerich, first to Dr. Biehl's laboratory, the so-called Wicking Institute. The layout and equipment of the laboratory produced a very favorable impression on the guests. First they were shown a motion picture of samples of raw mix and cement enlarged 700 diameters to demonstrate the chemical composition and structure of the samples. This was followed by a trip through the plant, whose plan was shown to the visitors two days before at the Amme-Giesecke Co. Particularly interesting were the new clinker coolers built on the Andreas system and whose shape differs from the usual rotary type.

### *The Dyckerhoff Mill*

Late in the afternoon the trip continued from Münster to Köln and up the Rhine to Wiesbaden, where the Biebrich plant of Dyckerhoff & Söhne was to be inspected the next morning. This plant seemed to interest the visitors quite especially, as the name Dyckerhoff was quite familiar to them, Dyckerhoff cement having been the cement construction used throughout the United States before the formation of the national industry. The Statue of Liberty in New York Harbor, the famous George Washington monument, and the White House were built with Dyckerhoff cement. The antiquated system of conveying the material from the quarry now in the plant is being torn down to be replaced by an electric railway. The seven kilns, located alongside of each other, make clinker from a slurry stored in 42 silos. The favorable location on the Rhine permits direct loading of the greater part of finished cement into ships through a subway under the street. After luncheon in the famous Wiesbaden Kurhaus the guests left for Heidelberg.

They were taken thmrough the Leimen cement plant under the direction of general director Kommerzienrat Dr. Schott. The outstanding feature of this plant is that most of the machinery used in made right in the plant. The plant also has a cooperage establishment and a cement products plant, in which are manufactured wood-concrete block and many other products used locally, such as concrete posts for vineyards, concrete trellises for roses, hotbed frames, reinforced concrete tiles and concrete lumber.

The afternoon and the following Sunday were spent going through the famous university and the splendid Heidelberg castle, where a festival with torch lighting was held that evening. An automobile ride through the beautiful Neckar valley completed the interesting and instructive trip. Mr. Abrams left the next day in an airplane going down the Rhine to Amsterdam, where he was to attend the International Congress of Testing Materials.

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## Crews of Dredges and Sand Sand Barges Not in Maritime Employment

THE crews of dredges and barges in sand and gravel dredging operations and employes operating stationary winch engines upon floats alongside of or attached to sand and gravel docks in connection with unloading operations are not covered by the Longshoremen's and Workers' Compensation Act, it is held by the United States Employes Compensation Commission in a ruling involving employes in such operations in the Ohio river. It was held, however, that laborers not members of the crew assisting in unloading sand and gravel barges are in maritime employment within the meaning of the act while working on the dredges or barges. The ruling, in full text, follows:

The question submitted pertains to the employes of companies engaged in sand and gravel operations in the Ohio river, described as follows:

A dredge, in charge of a boss with an engineer and laborers who act as the crew of the dredge and also as laborers in taking out sand and gravel, is fitted with machinery which operates an endless chain series of buckets that take the sand out of the river and empties it into barges. In some cases the master and crew of the dredge are furnished living quarters thereon during operating periods.

### *Steel Crane Performs Most of Unloading*

After being loaded the barges are towed by steamer to the point of unloading. The main part of the unloading operation is performed by a steel bridge crane built upon the shore with a steam shovel that takes the sand from the barges and transfers it to conveyors that carry it to the sand piles. Certain laborers work on the barges scooping up the sand the steam shovel cannot reach. While a barge is being unloaded a man, stationed on a floating pumpboat tied up to the bank, operates a winch engine to move the barge along as the shovel takes out the sand. Another man is employed on a float below to catch the empty barge and place it in the empty landing.

Section 2 (3) of the Longshoremen's and Harbor Workers Compensation Act reads:

"The term 'employe' does not include a master or member of a crew of any vessel, nor any person engaged by the master to load or unload or repair any small vessel under 18 tons net."

At no time, regardless of what work he may be doing, does the master or any member of the crew of a vessel come under the provisions of the act.

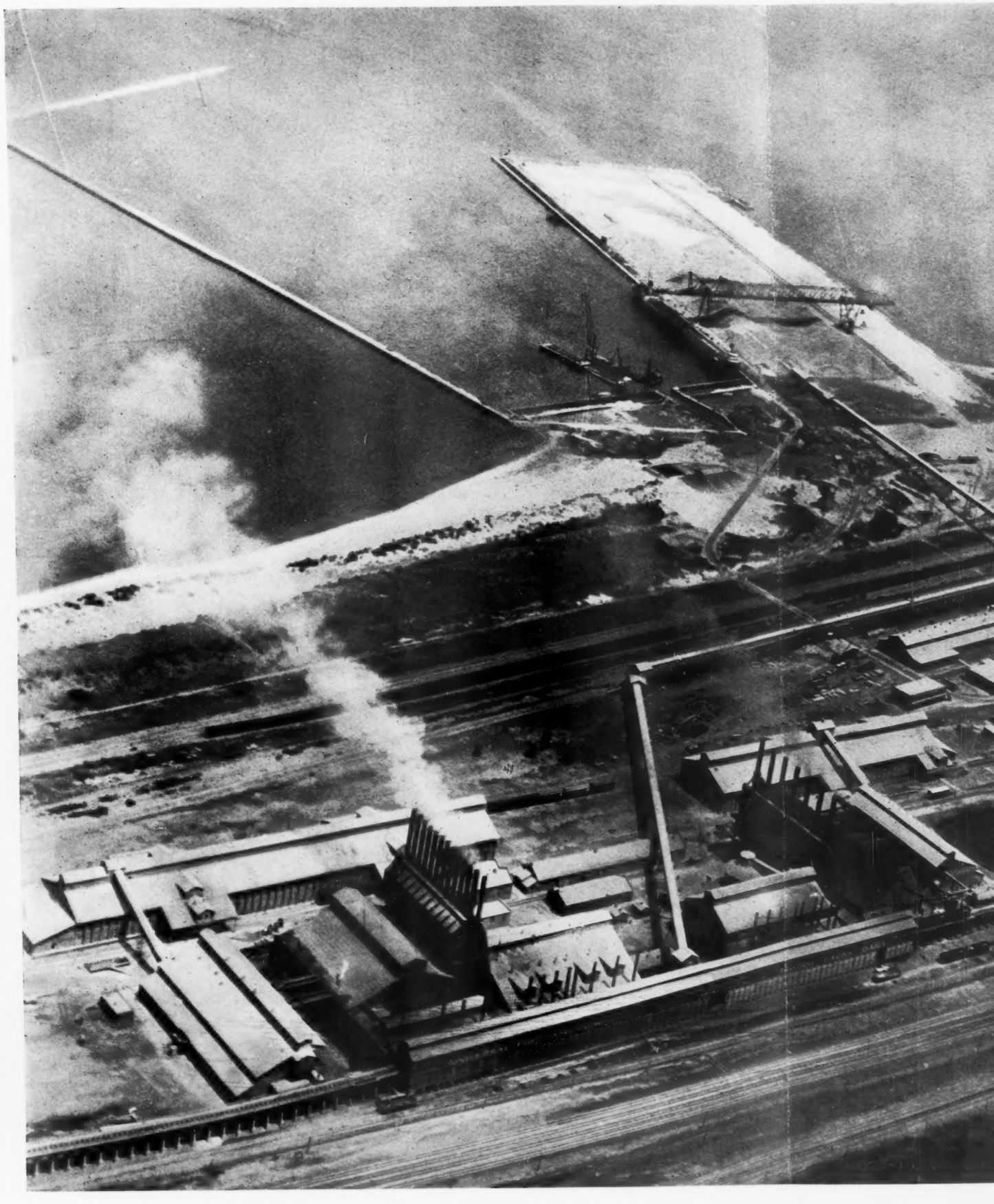
In the case of De Gaetano v. Merritt and Chapman Co., 196 N. Y. Supp., 573, it was held that a diver, on a scow equipped with derrick, hoisting engine and air compressor to furnish air to divers, but without means of self-propulsion, was a member of the crew of a vessel and "engaged in the very service for which the vessel was equipped and operated." The eight-hour day cases reported in 206 U. S., 246, held that cranemen, assistant cranemen and scowmen working on dredges and the scows used in connection with dredging operations were seamen and not laborers or mechanics under the eight-hour law.

### *Employes Are Ruled To Be Part of Crew*

In the present case the employes regularly working on the dredges or sand barges are a part of the crew thereof and the stationary engineer working on each float must be considered also as a member of the crew.

The only persons engaged in the sand and gravel operations described herein, who are covered by the Longshoremen's and Harbor Workers' Compensation Act are those employes (not members of the crew) who are employed to work on the barges and assist in the unloading thereof.

In its work of administering said act the United States Employes' Compensation Commission will take no action at this time against employers of men serving on said sand and gravel dredges and herein considered as exempt from the law, if such employers decide not to cover by insurance or by self-insurance such liability as they may have under the act for injuries to employes.



*Aeroplane view of the Buffington, Ind., cement mills of the Universal Portland Cement Co., which have*

*and Cement Co., which have a daily capacity of 10,000 bbl. The recently completed $2,000,000 outer harbor sh*

Kaufmann and Fabry, Chicago

*harbor shows in the upper background*

# Proportioning Raw Cement Materials

## Use of a System of Triangular Co-ordinates Compared with Algebraic Methods

By Edgar S. Ernst,* Walter S. Ernst† and William A. Ernst‡

THE rise of the portland cement industry to one of the most important in the United States has been little short of meteoric due to the great increase in the use of cement as a building material. Coincident with the education of the public regarding the merits and posibilities of cement, many improvements in processes and methods of manufacture have been made. Until a short while ago, however, most of them were confined to equipment and to lowering the cost of production. Recent years have seen the launching of an active campaign to improve the quality and usefulness of the product as well. With this idea in mind, many programs of investigation and research have been undertaken with the view to ascertaining the proper combinations of the essential ingredients—silica and the oxides of aluminum, iron and lime—to employ to produce a product satisfying the ideal conditions of high quality and low cost.

Investigation has shown that normal portland cement clinker is composed of tri-calcium silicate, $3CaO \cdot SiO_2$, di-calcium silicate, $2CaO \cdot SiO_2$, tri-calcium aluminate, $3CaO \cdot Al_2O_3$, and unidentified compounds largely glasses of iron and the other oxides which it may contain.[1] Late investigations have tended to show that the tri-calcium silicate and the di-calcium silicate are usually present in approximately equal amounts, though that is not necessarily always the case. Meade,[2] basing his work on this idea, has proposed a formula expressing the combining relations of the several constituents as follows:

$$\frac{2.3\times\%SiO_2+1.7\times\%Al_2O_3+\%Fe_2O_3}{\%CaO+1.4\times\%MgO-0.7\times\%SO_3}=1.0$$

The hardening properties of cement when mixed with water are attributed to the silicates present, while the setting properties are credited to the aluminates. The oxides of aluminum and iron play a most important part in the formation of the clinker, also, for the difficulty which would be experienced in burning a straight silicate mixture under present-day practice necessitates the addition of fluxing materials in the form of these oxides (and related ones) in order to render chemical combination possible at the temperatures usually found in the rotary kiln. These additions must be made judiciously, due regard being paid to their effect on the resulting clinker during and after formation.

### *Raw Material Ratios*

The usual method employed in keeping them within their rather restricted bounds is to select raw materials in which the silica, alumina and oxide of iron bear such a relation to one another as to easily and readily admit of combinations which will produce the following approximate ratios in the finished product:

$$\frac{SiO_2}{R_2O_3}=2.0\text{—}2.2$$

$$\frac{SiO_2}{Al_2O_3}=2.75\text{—}3.0$$

$$\frac{Al_2O_3}{Fe_2O_3}=2.4\text{—}2.6$$

These ratios should be taken as only approximate, since local conditions and materials at one plant may allow the use of certain ratios which would be ruinous at another.

Some materials contain ingredients which may prove harmful when found in large amount. Among these may be mentioned magnesia, sulphates, phosphates, free silica, and alkalies. The standard specifications under which most cements are marketed limit the percentages of several of these, while manufacturing conditions tend to keep the others in check.

Free silica should be eliminated as far as possible, since it does not readily react with the basic elements of the mix, and hence fails to perform its proper function. Fine grinding helps to overcome this difficulty in a measure, but it is usually found difficult to grind fine enough when free silica forms part of the mix. Dupuis[3] says: "The elimination of quartz constituents of a mix greatly increases its aptitude to calcination." ". . . the reaction of sand particles is slow and takes place gradually. Depending on the size of particles, this reaction may take place during the entire period of calcination and may not even be completed then." . . . "The fineness of the mix plays an important part in determining the aptitude to calcination." (At least one mill in the East, working on shell marl which contains free silica, has installed special washers to remove this material before making its mixtures.)

Sulphates and magnesia must be kept to a minimum, for, aside from their doubtful value to the mix, too great concentrations will run the final content up over the limits set by the standard specifications. These specifications serve as a guide in determining the amount that can be allowed in the several materials making up the mix.

With the limiting ratios fairly well established, and, given raw materials in which two, or more, of the ingredients are properly combined, the calculation of the raw mixture becomes a simple affair—one of simple proportion. That is the condition which obtains in most of the Lehigh district—the cradle of the American cement industry. It was a popular idea for many years that such conditions were essential to the production of portland cement. Nothing could have been further from the truth, for today millions of barrels of it are being produced annually from materials other than the limestone and cement-rock used there.

Quite often in the selection of the site for a new plant there is some question as to the suitability of the suggested raw materials. This is especially true in those sections not so favored by nature as the district mentioned above, and where there is a scarcity, or absence, of materials having their ingredients combined in approximately proper ratios.

Ofttimes large supplies of material, satisfactory from a purely cost standpoint, are found conveniently at hand, but which show, on analysis, that their ingredients are combined in such relation to one another as to make correcting additions necessary. The question then becomes, "Will this material, since it does not lie within the generally accepted range, readily lend itself to mixture with other equally accessible supplies to form a synthetic material in which the necessary ratios are satisfied?" Various methods for determining this point have been suggested and used in the past. Some depended on actual combinations and trial burnings, while others were based on more or less complicated calculations. Since so much of the future success of operation depends on securing proper information regarding this matter, the use of either method is justified. However, many, though deeply interested, do not have the facilities or time for carrying out these tests, or may not be familiar with the methods of calculation. Therefore a short and accurate graphical method whereby the suitability and mixing proportions of the several materials could be quickly ascertained, in such cases, seemed necessary to the writers.

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### *Fundamentals of Graphic System*

Accordingly, several years ago a method based on a system of triangular co-ordinates was worked out and applied to this problem. Leath and Meade[4] and others have made use of this system in classifying the igneous rocks chemically, Haarman[5] suggested a method for classifying asphalt sands by means of it, Colbjörnsen[6] applied it to the mixing of fertilizers, and much use has been made of it in attempting to show the composition and properties of finished portland cement clinker graphically in relation to other similar mixtures or materials. Doubtless many others have used it for other purposes also, but no case has been noted by the writers where this method has been applied to the proportioning of portland cement raw mixtures.

The purpose of this paper is, therefore, to suggest a method whereby engineers and others may more quickly and more or less accurately determine, depending on the care taken, whether or not a certain group of raw materials can be combined to form a desired mixture and, if so, the approximate proportions in which they would have to be combined in order to attain this result.

In suggesting this method it is realized that materials containing only the three essential constituents would rarely be found, and that the presence of adulterating material, which cannot be shown very well on the graph, would inject errors into the results unless provision were made to take care of them. Two means are available for doing this.

First, by observing the rule of keeping the MgO content below, let us say, 3% and grouping this with the CaO and setting the limit of the remaining impurities, exclusive of iron oxide, at, or below, 2% (all on a calcined basis) and grouping iron oxide with alumina, titanium with silica, etc., fair accuracy can be obtained by its use. This method could be used where great accuracy is not absolutely essential or where only approximate ratios are desired.

The second method would employ the same limiting percentages for impurities, but calls for the calculation of the essential ingredients to a 100% basis, plotting of their position on the graph on this basis, and later reconversion of the ratios so obtained from the graph to the basis on which the materials are to be used. This is the better method, since, as can be seen, it is the more accurate of the two.

Before going into the discussion of this method, however, for the sake of comparison it might be well to outline the more lengthy method of calculation and to call attention to the fact that the triangular co-ordinate method is not offered to replace, but simply to supplement, usual practice.

### *Algebraic Method*

Having given raw materials analyzing as follows:

| | LIMESTONE Basis: Natural | Calcined | 100% cement-making ingredient |
|---|---|---|---|
| $SiO_2$ | 1.22% | 2.14% | 2.16% |
| $Al_2O_3$ | 0.34 | 0.60 | 1.38 |
| $Fe_2O_3$ | 0.44 | 0.77 | |
| CaO | 54.46 | 95.59 | 96.46 |
| MgO | 0.48 | 0.84 | ..... |
| $SO_3$ | 0.03 | 0.05 | ..... |
| Loss and N.D. | 43.03 | ..... | ..... |

| | SHALE | | |
|---|---|---|---|
| $SiO_2$ | 56.38% | 65.10% | 68.23% |
| $Al_2O_3$ | 20.00 | 23.09 | 30.88 |
| $Fe_2O_3$ | 5.52 | 6.37 | |
| CaO | 0.74 | 0.85 | 0.89 |
| MgO | 2.33 | 2.69 | ..... |
| $SO_3$ | 1.64 | 1.89 | ..... |
| Loss and N. D. | 13.49 | ..... | ..... |

and using Meade's formula (given above) we would proceed as follows:

LIMESTONE

$2.14 \times 2.3 = 4.922$
$0.60 \times 1.7 = 1.020$
$0.77 \times 1.0 = 0.770$

$6.712 = A$

$95.59 \times 1.0 = 95.590$
$0.84 \times 1.4 = 1.176$

$96.766$
$0.05 \times -0.7 = -0.035$

$96.731 = B$

$B - A = 96.731 - 6.712 = 90.019 = C$
(Available base)

SHALE

$65.10 \times 2.3 = 149.730$
$23.09 \times 1.7 = 39.253$
$6.37 \times 1.0 = 6.370$

$195.353 = A'$

$0.85 \times 1.0 = 0.850$
$2.69 \times 1.4 = 3.766$

$4.616$
$1.89 \times -.7 = -1.323$

$3.293 = B'$

$A' - B' = 195.353 - 3.293 = 192.060 = C'$
(Available acids)

$$\frac{C'}{C} = \frac{192.060}{90.019} = 2.1337 =$$

parts of limestone to be mixed with one part of shale.

Combining in these proportions should give a clinker of the following composition when burned without contamination:

| | |
|---|---|
| $SiO_2$ | 22.23% |
| $Al_2O_3$ | 7.77 |
| $Fe_2O_3$ | 2.55 |
| CaO | 65.35 |
| MgO | 1.43 |
| $SO_3$ | 0.67 |
| | 100.00% |

### *Three Component Mix (Algebraic Method)*[7]

In this case the materials used for the purposes of illustration are a siliceous limestone, a high-grade limestone and a clay. The particular ratios selected will result in a high-limed clinker but can be replaced by others as conditions warrant.

| | LIMESTONE (III) Basis: Natural | Calcined | 100% C-M Ingred. |
|---|---|---|---|
| $SiO_2$ | 12.00% | 19.27% | 20.01% |
| $Al_2O_3$ | 1.73 | 2.78 | 3.76 |
| $Fe_2O_3$ | 0.52 | 0.84 | |
| CaO | 45.70 | 73.39 | 76.22 |
| MgO | 2.15 | 3.45 | ..... |
| Loss | 37.75 | ..... | ..... |
| Residue | 0.15 | 0.27 | ..... |

| | LIMESTONE (IV) | | |
|---|---|---|---|
| $SiO_2$ | 0.16% | 0.28% | 0.28% |
| $Al_2O_3$ | 0.06 | 0.11 | 0.15 |
| $Fe_2O_3$ | 0.02 | 0.04 | |
| CaO | 55.40 | 98.67 | 99.67 |
| MgO | 0.43 | 0.77 | ..... |
| Loss | 43.84 | ..... | ..... |
| Residue | 0.09 | 0.13 | ..... |

| | CLAY (V) | | |
|---|---|---|---|
| $SiO_2$ | 58.30% | 64.83% | 67.06% |
| $Al_2O_3$ | 22.76 | 25.31 | 30.19 |
| $Fe_2O_3$ | 3.49 | 3.88 | |
| CaO | 2.30 | 2.56 | 2.65 |
| MgO | 1.65 | 1.83 | ..... |
| Loss | 10.10 | ..... | ..... |
| Residue | 1.40 | 1.59 | ..... |

Basing our calculations on the calcined material and using the following symbols and ratios:

| | (III) | (IV) | (V) |
|---|---|---|---|
| $SiO_2$ | $S_1$ | $S_2$ | $S_3$ |
| $R_2O_3$ | $O_1$ | $O_2$ | $O_3$ |
| CaO | $L_1$ | $L_2$ | $L_3$ |

$$r = \frac{SiO_2}{R_2O_3} = 2.6$$

$$R = \frac{CaO}{SiO_2 + R_2O_3} = 2.26$$

Solve the following:

$a = S_1 - rO_1$ $\quad d = L_1 - (S_1 + O_1)R$
$b = rO_2 - S_2$ $\quad e = (S_2 + O_2)R - L_2$
$c = rO_3 - S_3$ $\quad f = (S_3 + O_3)R - L_3$

The proportions of the three components are then as follows:

(III) : (IV) : (V)
ec — bf : ea — bd : cd — fa

If III is taken as the unit, or,

$$III = 100$$

$$IV = \frac{cd - fa}{ec - bf} \times 100$$

$$V = \frac{ea - bd}{ec - bf} \times 100$$

Substituting values, we have:

$a = 19.27 - 2.6(2.78 + 0.84) = 9.86$
$b = 2.6(0.11 + 0.04) - 0.28 = 0.11$
$c = 2.6(25.31 + 3.88) - 64.33 = 11.06$
$d = 73.39 - (19.27 + 2.78 + 0.84)2.26 = 21.66$
$e = (0.28 + 0.11 + 0.04)2.26 - 98.67 = -97.70$
$f = (64.83 + 25.31 + 3.88)2.26 - 2.56 = 209.92$

Then

III = 100 parts by weight.

$$IV = \frac{(11.06 \times 21.66) - (209.92 \times 9.86)}{(-97.70 \times 11.06) - (0.11 \times 209.92)} \times 100 = 165.83 \text{ parts.}$$

$$V = \frac{(-97.70 \times 9.86) - (0.11 \times 21.66)}{(-97.70 \times 11.06) - (0.11 \times 209.92)} \times 100 = 87.50 \text{ parts.}$$

Calculated to the basis of the natural materials, the mixture is, therefore, made up of:

$$\left.\begin{array}{r} 100 \div .5995 = 166.805 \\ 165.83 \div .5564 = 298.040 \\ 87.50 \div .8685 = 100.748 \end{array}\right\} \div 565.593 = \left\{\begin{array}{l} 29.492\ \%\ \text{of III} \\ 52.695\ \ \text{of IV} \\ 17.812\ \ \text{of V} \end{array}\right.$$

565.593

Mixing in these proportions should give a raw mixture which would produce a clinker of the following composition when burned with gas or oil (that is, under conditions where the mix would not be altered or contaminated by further additions from fuel ash, etc.):

| | |
|---|---|
| $SiO_2$ | 21.64% |
| $R_2O_3$ | 8.32 |
| CaO | 67.72 |
| MgO | 1.79 |
| Residue | 0.53 |
| | 100.00% |
| r = | 2.6 |
| R = | 2.26 |

### Graphical Method

The triangular co-ordinate method for the proportioning of cement raw materials consists of employing an equilateral triangle, the perpendicular distance from apex to opposite side of which is taken as 100. (Some divide the length of the side into 100 parts. In either case the principles involved are identical.) The apices represent 100% of CaO, $SiO_2$, $R_2O_3$, as shown in Fig. 4; any point on a side represents a binary mixture of the materials shown at the adjacent corners, while any point within the triangle represents a mixture made up of the three materials. Since, from geometry, we know that the sum of the perpendiculars from a point within an equilateral triangle to the sides is constant and equal to the altitude of the triangle, we can say that in each case mentioned above the sum of the percentages of CaO, $SiO_2$ and $R_2O_3$ making up the mixture is 100. Thus in Fig. 1:

$$A + B + C = XY = 100$$

By the rule applied to the solution of problems in leverage, we know that the weight times the weight-arm is equal to the power times the power-arm. Applying this rule to the diagram (Fig. 2) we have:

$$A \times AG = F \times GF$$

This can be put into the form:

$$\frac{A}{F} = \frac{GF}{AG} \text{ or,}$$

$$A : F :: GF : AG$$

In other words, to produce G, A and F must be grouped in inverse ratio to their distances from G. (Medial proportion.)

Again, if four quantities are in proportion, they are in proportion by composition, that

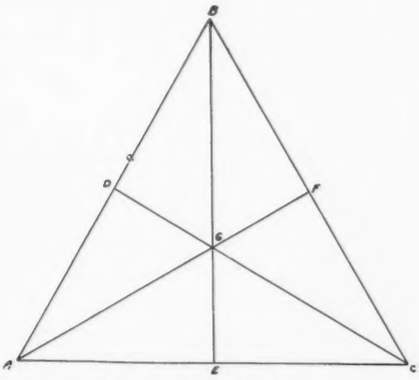


*Fig. 2. Illustrating the law of transversals referred to below*

is, the sum of the first two terms is to the first term as the sum of the last two terms is to the third term. The above then becomes:

$$A : A + F :: GF : GF + AG, \text{ or}$$

$$A : G :: GF : AF$$

from which we find that

$$A = G\frac{GF}{AF}$$

Similarly

$$B = G\frac{GE}{BE}$$

and

$$C = G\frac{GD}{CD}$$

By the theorem of transversals, we know that if the angular transversals of a triangle intersect one another in a single point the sum of the ratios of the footpieces to their transversals is equal to 1.0. Thus in Fig. 2

$$\frac{GF}{AF} + \frac{GC}{DC} + \frac{GE}{BE} = 1.0$$

Multiplying through by G,

$$G\frac{GF}{AF} + G\frac{GC}{DC} + G\frac{GE}{BE} = G$$

or, as above,

$$A + B + C = G$$

So much for the mathematics of the method.

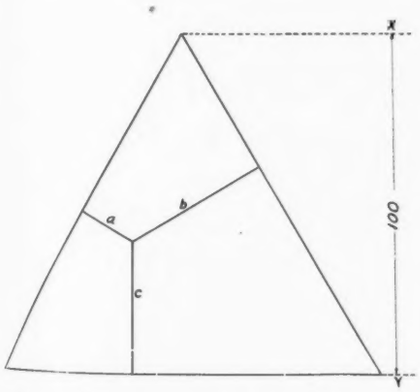


*Fig. 1. The geometrical basis for the method; sums of three perpendiculars equal altitude or 100%*

### Example of Use of Method

In the case of the two component mixture given above it was shown that the limestone and shale would have to be combined in the proportion of 2.133 parts of limestone to 1.0 part of shale in order to produce the desired composition. The means

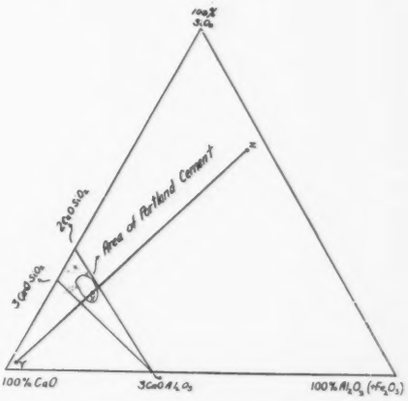


*Fig. 3. Finding the proportions graphically for two-component mix*

of attaining this result by the use of the triangular co-ordinate method are as follows:

First, fix the point representing the composition of the desired mixture (calculated on the basis of the three essential constituents, grouping iron oxide and alumina as $R_2O_3$). Using the first method suggested and, for convenience of comparisons in this case, using the clinker analysis given above, in the example of a two component mixture, as the desired composition, we would group the CaO, MgO and $SO_3$ into one and designate it as CaO. This would give us a figure of 67.41. Similar grouping of the iron oxide and alumina gives us 10.32. The $SiO_2$ is 22.23. The point representing this analysis is denoted by X (Fig. 3).

Similar grouping of the constituents of the limestone and of the shale give us points Y and Z respectively. Now, as shown above, in order for Y and Z to produce X they must be combined in inverse ratio to their distances from X.

Thus:

$$Y : Z :: XZ : XY$$

Or, measuring the projections of XZ and XY on the CaO scale,

$$Y : Z :: (67.41 - 5.43) : (96.48 - 67.41)$$

$$\text{Or, } \frac{Y}{Z} = \frac{61.98}{29.07} = 2.132+$$

(Had the second method been employed, X would have been found at the point representing

| | |
|---|---|
| CaO | 66.75% |
| $R_2O_3$ | 10.54 |
| $SiO_2$ | 22.71 |

and the proportion $\frac{Y}{Z}$ would have been $\frac{66.458}{31.139} = 2.134$ parts of limestone to be used with one part of shale to make up the proper mixture.)

Thus, as above, we would use 2.132 parts of limestone (on a calcined basis) to one part of shale (also on a calcined basis) to produce our standard mixture.

The problem has, therefore, resolved itself into the location of three points, measurement of the two segments which are produced by dividing the line which joins the points representing the two materials at the point representing the desired mixture and then obtaining the ratio of the lengths of these segments to one another. This gives the combining ratio on a calcined basis. It can be converted to one applicable to the natural materials by dividing it by the percentages of non-volatile matter in the respective materials.

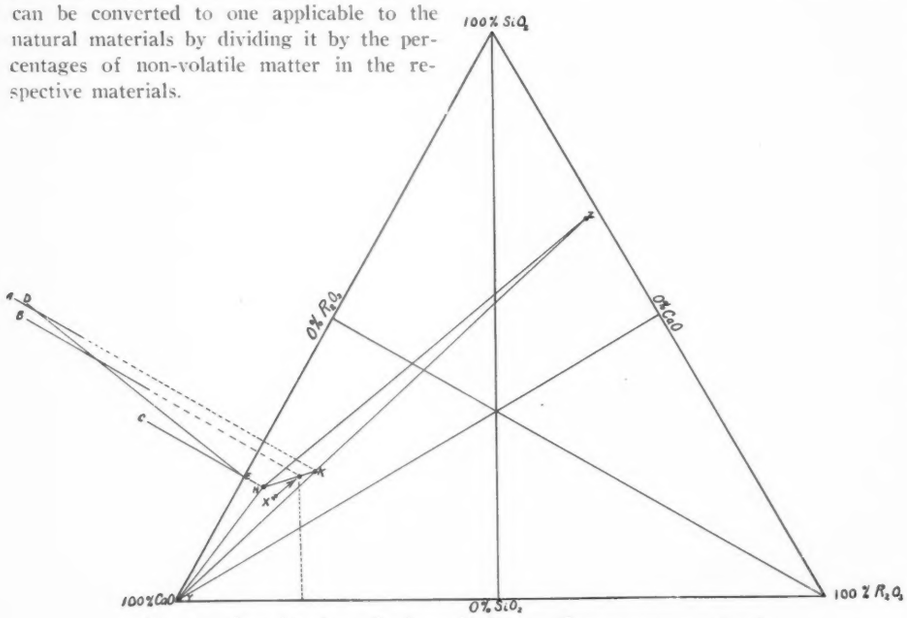


***Fig. 4. Graphical method applied to a three-component mix***

In this case we knew before plotting that we could produce the desired mixture from the materials submitted. Should X (the desired mixture) not fall on the line joining Y and Z, however, we would immediately know that X could not be produced from these two materials without the addition of a third material. That brings us to the three component mixture.

### *Three Component Mixture*

It is when more than two materials are to be combined that the triangular co-ordinate method is of the greatest value in shortening calculations. By use of it, we can immediately locate the range in which the correcting third material must lie in order to form the proper mixture with the other two materials.

The first step is the location of the point representing the desired mixture. Since this point (X) remains fixed for any particular standard mixture only one determination need be made for any number of problems. It is obtained from the ratios desired in the finished clinker, as shown below.

Let us say that X falls to the left of line YZ connecting the points representing limestone (IV) and clay (V) (Fig. 4).

Since all combinations of Y and Z lie on YZ and X does not, we know that we cannot produce X without the aid of some correcting material. If we select a third raw material, however, which will allow us to construct a triangle which includes X (that is, some material lying in the field to the left of X) our problem is readily solved.

All that need be done is to construct the triangle YZH which includes X, extend the line HX to K, and measure the segments HX, XK, YK, and KZ. K represents the mixture of Y and Z which combined with H in the proper proportion will produce X. Thus HX parts of K combined with XK parts of H will produce X. K is further divided into KZ parts of Y and YK parts of Z. (These proportions are all on a calcined basis.)

### *Example*

In the example of a three component mixture, given above, we saw that a clinker was desired in which the following ratios would exist:

$$\frac{CaO}{SiO_2 + R_2O_3} = 2.26$$

$$\frac{SiO_2}{R_2O_3} = 2.60$$

Since, in the diagram, the sum of the percentages of $SiO_2$, $R_2O_3$, and CaO is 100, we can say:

$$CaO + SiO_2 + R_2O_3 = 100 \quad \text{and}$$
$$SiO_2 = 2.6\, R_2O_3$$
$$CaO = 2.26\,(SiO_2 + R_2O_3)$$
$$= 2.26\,(3.6\, R_2O_3)$$
$$= 8.136\, R_2O_3$$

Then,

$$8.136\, R_2O_3 + 2.6\, R_2O_3 + 1.0\, R_2O_3 = 100\%.$$

From this we can readily show that the

$$CaO = 69.32\%$$
$$SiO_2 = 22.16$$
$$R_2O_3 = 8.52$$

in a clinker calculated to a basis of 100% cement-making ingredients and satisfying the above ratios. Plotting these values will give us our point X.

Plotting raw materials III, IV and V (Fig. 4) on the basis of 100% cement-making material (given above) will give us the points H, Y and Z respectively. Then construction of the triangle HYZ and transversal HK and measurement of the segments produced, as explained above, will show that $\frac{KY}{KZ} = \frac{3.45}{6.55}$ and that $\frac{HX}{XK} = \frac{10.0}{3.95}$.

NOTE.—Drawing parallel lines AK, BX and CH and transversal DE will be found of assistance in determining the ratio of the segments HX and XK to one another when the line HK is short. (If two lines are cut by any number of parallels the corresponding intercepts are proportional.)

Thus 10.0 parts of K must be added to 3.95 parts of H to produce X. K (10.0 parts) is further divided into 3.45 parts of Z and 6.55 parts of Y. So, in order to produce our mixture X, it is necessary to mix 3.95 parts of raw material III with 6.55 parts of IV and 3.45 parts of V, all considered on a 100% cement-making basis. To change this over to the basis of the natural raw materials we would need only divide the parts, as above, by their respective percentages of cement making materials as found in the natural state, as follows:

$$\left.\begin{array}{l} 3.95 \div .5995 = 6.9224 \\ 6.55 \div .5564 = 11.7900 \\ 3.45 \div .8685 = 3.9608 \end{array}\right\} \div 22.6732 = \left\{\begin{array}{l} 29.50\% \\ 52.71 \\ 17.79 \end{array}\right.$$

$$22.6732$$

This compares very favorably with the longer algebraic method of calculation.

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[1]Rankin, AM. J. Sci. 39, 1 (1915).
[2]Meade, Portland Cement, 1926.
[3]Dupuis, Rock Prod., Nov. 27, 1926, p. 55.
[4]Leath and Mead, Metamorphic Geology.
[5]Haarman, Eng. News-Record, June 26, 1924.
[6]Colbjornsen, Ind. & Eng. Chem, July, 1926.
[7]W. A. and E. S. Ernst, Rock Products, Nov. 13, 1926.

## Cement Containing Magnesia Satisfactory

IF care is used in the manufacture, cement containing as high as 6.5% magnesia can be made which will have satisfactory properties, according to a written statement issued by the Bureau of Standards of the Department of Commerce, September 12. The full text of the statement follows:

If care is used in its manufacture, cement containing as high as 6.5% magnesia can be made which will have satisfactory properties. However, in general it is doubtful whether the present limit of 5% magnesia (A.S.T.M. specification) should be exceeded.

For many years the Bureau of Standards has been studying the properties of high magnesia cements. The cements have been prepared in the bureau's experiment plant and have contained from normal to very high percentages of magnesia. The data obtained in testing specimens made from these cements at early ages and a detailed discussion of the work have already been published as Technologic Paper No. 102. The present conclusion is based on additional information obtained in testing 10-year old concrete specimens made from the cements.

## Plans Perfected for National Sand and Gravel Exhibit

PLANS for the exhibit of the Manufacturers' Division of the National Sand and Gravel Association at the Detroit convention, January 4, 5 and 6, 1928, have been perfected and details have been sent out by V. P. Ahearn, executive secretary of the association, Munsey Bldg., Washington, D. C. The convention will be held at the Book-Cadillac hotel and about the same plan has been adopted as for the National Crushed Stone Association exhibit at the same hotel a year ago.

The privilege of exhibiting is extended to those firms which are either associate members of the organization or which are regularly represented in the advertising columns of the *National Sand and Gravel Bulletin.* Any firm which comes under either of these classifications is entitled to exhibit.

Charles H. Ray, Jr., of the Ray Sand and Gravel Co., Detroit, is general chairman of the convention committee. L. J. Dyament, of the Ward Sand and Gravel Co., Oxford, Mich., is chairman of the sub-committee on entertainment, and L. E. Williams, general superintendent of the Ray Sand and Gravel Co., is chairman of the sub-committee on exhibits.

Everything points to the largest convention in the history of the industry, and the work on the program is proceeding rapidly.

## Plans New Gravel Plant for Washington State

A NEW storage bunker, a gravel washing and screening plant and a new rock crushing plant will be constructed on a Chehalis river site near Montesano, Wash., by the Harbor Sand and Gravel Co., it was announced recently by F. R. Monahan, manager. The property and another in Hoquiam were recently acquired by the concern preparatory to an extension in those cities.

The new bunkers in Montesano will have a capacity of 800 yd. of sand and gravel and will have both water and rail transportation facilities. A Sauerman high line cable will be installed to convey the sand to the hoppers and thence to the washing and screening plants. From the bunkers the material will be loaded on barges or cars for distribution.

Because of the increasing demand for crushed rock, the company will install a crusher and will be able to supply this product in large quantities, Mr. Monahan said. Crushed rock is favored as a road surface and its use here is expected to increase rapidly.

The company will continue the operation of its storage bunkers at Market and O streets, along the Wishkah river bank, and contemplates further extension soon on the Hoquiam site. The properties and new plants represent an investment of several thousand dollars, Mr. Monahan stated.—*Montesano* (Wash.) *Vidette.*

## Orange County Rock Company Reorganized with New Name

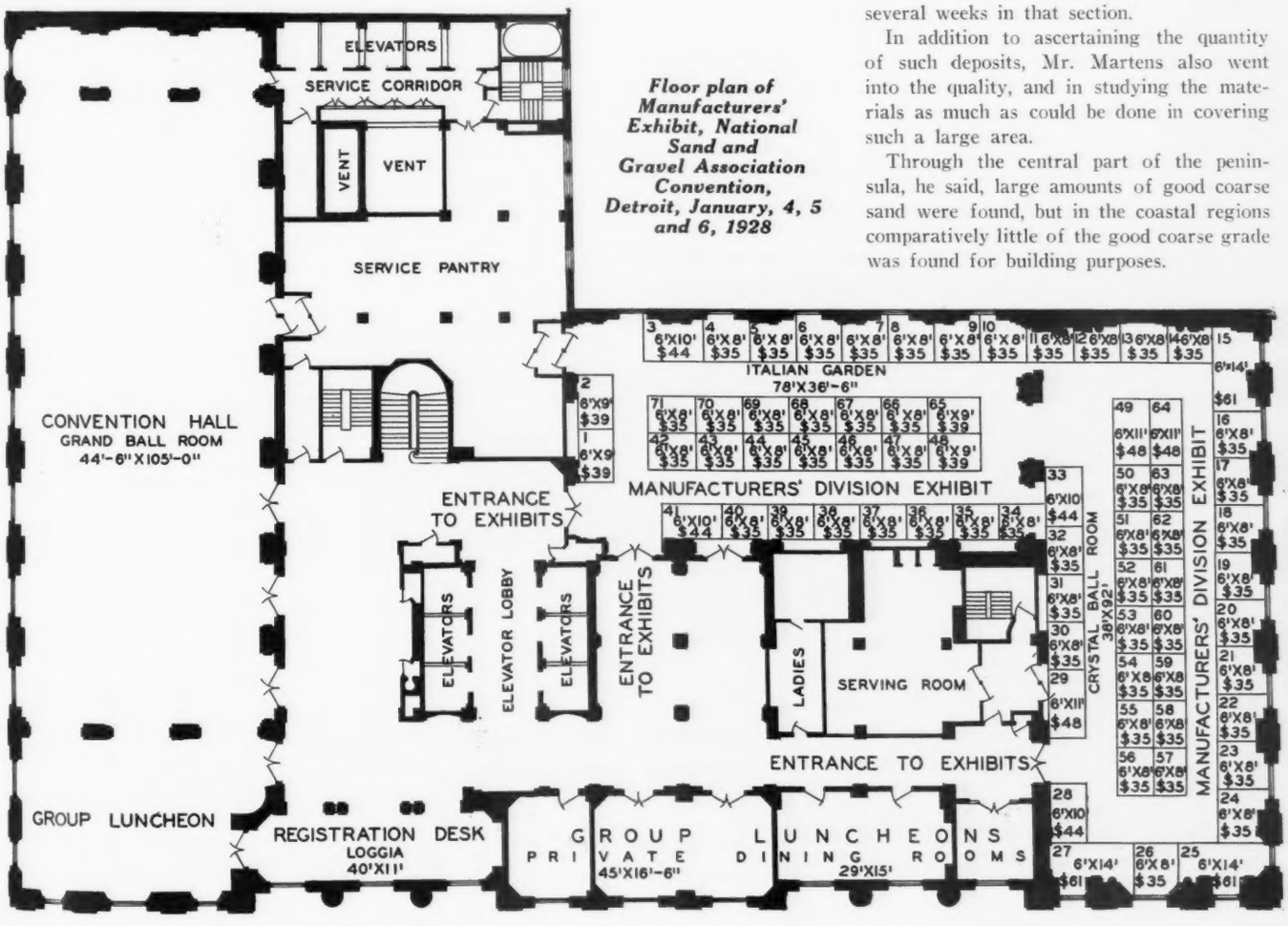
THE Orange County Rock Co., crushed stone producers of Orange, Calif., has recently been reorganized under the new name of Imperial Rock Corp. The new company will operate only in the Imperial Valley at Frink (Niland postoffice), Calif., and its rock plant and business in Orange, Calif., have been sold. The offices of the company are at Frink and El Centro, Calif. Officers of the new company, which began operating at Frink on September 19, are A. G. Wright, president, and W. F. Blaikie, secretary and treasurer.

## Seek Sand and Gravel Deposits in Florida

A GENERAL investigation of the sand and gravel deposits of peninsular Florida has just been conducted by J. H. C. Martens, assistant state geologist, who spent several weeks in that section.

In addition to ascertaining the quantity of such deposits, Mr. Martens also went into the quality, and in studying the materials as much as could be done in covering such a large area.

Through the central part of the peninsula, he said, large amounts of good coarse sand were found, but in the coastal regions comparatively little of the good coarse grade was found for building purposes.




***Floor plan of Manufacturers' Exhibit, National Sand and Gravel Association Convention, Detroit, January, 4, 5 and 6, 1928***

# Hints and Helps for Superintendents

## Manganese Crusher Protector

THE accompanying view shows a special manganese steel crusher guard (fitting over half of the yoke) for gyratory crushers. It is all one casting. This casting was made especially for the Lehigh Stone Co.,

***Crusher guard of manganese steel***

Kankakee, Ill., of which W. R. Sanborn is vice-president and general manager. It is presumed any manganese steel manufacturer could supply one for a standard crusher. Of course, such a guard restricts the crusher opening and is used only on the smaller sizes —here on some of the secondary crushers.

## Track-Throwing with a Tractor

By C. M. CHAPLIN

News Editor, K. L. Hamman-Advertising Inc. Oakland, California

A TRACTOR is a most useful machine about many plants and finds a variety of uses to which it may be put. Some interesting applications of this traction power have been made at the marl beds of the Sandusky Cement Co. Here a Caterpillar "Thirty" tractor is employed for stripping, track throwing, carrying ties for track extensions and other work.

Two men now throw all the track in considerable less time than by former methods by attaching a heavy chain to the outside rail and, passing it under the inside rail, easily and slowly move the track with the Caterpillar tractor to a position several feet away. By this method, approximately 85 ft. of track is moved at one time without any damage whatever to either rails or ties.

Having equipped the tractor with a bucket for stripping, the company found a novel use for the loader in carrying ties for track extentions. As many as 25 ties have been transported in this way from the base of supply to track extensions, a mile away.

***Tractor with bucket stripping the marl quarry***

The same machine equipped with a ⅓-yd. bucket is used in stripping the four to 14-in. of dirt and sod overburden from the marl deposits. Stripping proceeds at the approximate rate of 80 ft. per day, which is about three times as fast as the digging shovel removes the marl. This permits the tractor to be used for other jobs at the deposit.

## Stopping a Leak in a Compressor Piston

By W. L. HOME

Consulting Engineer, Pine Plains, N. Y.

A SINGLE stage air compressor which had been serviced by the company who made it and which had been worked on by many first class mechanics never delivered the amount of air it was supposed to deliver. In addition the valves heated and the machine seemed to be laboring at all times. To all appearances there seemed to be a leak but none could be found. The rings and valves were checked and found to be all right.

A last attempt to discover the trouble was made and the machine completely torn down and each part examined. It was finally discovered that a fair sized hole went right through the piston in a diagonal manner, but was blinded at both ends or faces except for a small area on each face of the piston which had been seen many times be-

***Carrying ties to track extension***

***Moving an 85-ft. section of track***

fore but which were considered but rough places in the casting but actually they were the termination of the larger diagonal hole. This was of course the source of the trouble. A chisel and a hammer soon exposed the true state of affairs.

To repair the trouble the cavity in the iron was first exposed to see just how big a territory the hole covered. This part was then drilled out by a hole normal to the face of piston. The hole was then tapped out to receive a ¾-in. pipe plug which was screwed tightly in place with "smooth-on cement" on the threads. The projecting portion of the pipe plug was then trimmed down to a smooth surface flush with the face of the piston. This repair job put a punch in the compressor that had never been there before and teaches a good lesson—a small leak of high pressure air in the cylinder of an air compressor does considerable damage!

## Surgical and Medical Aid Makes for Efficiency of Employes

By DR. C. R. TREAT

Industrial Surgeon Appointee of the Casualty Reciprocal Exchange, Kansas City, Mo.; Plant Physician in the Medical Department of the Chico Stone Products Co., Chico, Texas

AN expert in the quarry industry recently stated "that in principle the industry has nearly reached the height of mechanical development, and future progress will be made largely in the direction of low cost production through strict attention to the problems connected with efficient personnel and methods of management."

Commenting on the above, there is no doubt that efficiency is the watchword, and especially concerns the rock-crushing industry, viewed from the standpoint of plant medical supervision.

I believe this opinion as stated is in the main correct; but I will take occasion to emphasize again the necessity of first-aid measures, especially in minor and apparently trival injuries. Experience has proved, and a survey of the field in the past corroborates, that a great deal of trouble may be averted by first-aid measures instituted at once in minor injuries. Many an infection with subsequent surgical treatment has been arrested by the timely attention to small wounds. Viewed from the standpoint of efficiency, it spells economy for the company; and much subsequent disability and discomfort is saved and lost time prevented by employees laying off for a day or so, suffering more or less from reaction and soreness accruing from the accident.

*Dr. C. R. Treat*

With us here in Texas it means much, as our industrial laws require that any accident whereby an employe is off the payroll 24 hours or longer must be reported to the Industrial Accident Board. The number of such reports affect our "experience rating," which is the dominating factor in governing our insurance rate.

### *Lay-Offs Can Be Curtailed*

My experience as an industrial surgeon is that in the vast majority instances the laying off of an employe for a day or two can be curtailed. If the injury be given immediate attention, and the patient observed closely thereafter, much less reaction and suffering follows. If necessary for a short time, this employe may be transferred to another department, wherein the member injured would not be called into play, and eventually he can be turned back to his regular work. The result is, that a loss of man-hours is obviated, creating a saving to the company in more ways than one.

We maintain a first-aid station with equipment at both plants of the Chico Stone Products Co., the Texas crushed stone plant No. 1 and Lone Star plant No. 2, about two miles apart. After our company had been operating some time, another efficiency measure was instituted embracing medical service to employes. Each employe was solicited to voluntarily subscribe to a general medical fund, a nominal fee of 75c from the married and 50c from the single men deducted from each semi-monthly pay—this furnished all medical attention and supervision to the families of the employes, with the exception of maternity cases and venereal diseases. In these instances the charges averaged only half of the regular fee. At first sight one would not appreciate the scope of this work. The plant physician is not only family doctor, but renders a social service as well—in fact, he is "one of them!"

As an efficiency measure, this means much, the men know they do not have a doctor's bill to pay, and that their families are taken care of, and taken care of well. They can come to work with a degree of peace of mind, that otherwise they would not possess—it acts for efficiency!

Let me emphasize right here that this is separate and apart from the surgical rendition. All surgical attention and supplies are furnished by the company absolutely free.

As a matter of economy to the men, permit me to cite just an instance: a few years ago, we had an epidemic of measles throughout the county and I figured in the instance of one employe's family, it would have taken twelve years at the rate he was paying to have liquidated his doctor's bill; so you see it is mighty cheap doctoring.

Taking all in all, we feel that this is a real efficiency measure and begets loyalty and confidence towards the company. In our hands it has proved entirely successful. Let me state in closing that holding the appointment as industrial surgeon and occupying the position of plant physician covering the medical department works out to an advantage to all hands concerned. The crux of the whole situation is that efficiency is enhanced by medical department assistance.

***A novel way of coaling a big steam shovel***

## Coaling a Big Shovel

INTRODUCING a big shovel into quarry work has brought some new problems to the Carbon Limestone Co., Youngstown, Ohio. One of these was how to coal it quickly and efficiently. The method adopted is clearly shown in the picture. The crane, used as a locomotive, pushes a car of coal out to the shovel and then picks up the car and holds it at a point where the fireman of the shovel can fill his bunkers from it easily. The shovel and its work were described in the September 3, 1927, issue.

# Financial News and Comment

## RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS

**(These are the most recent quotations available at this printing. Revisions, corrections and supplemental information will be welcomed by the editor.)**

| Stock | Date | Par | Price bid | Price asked | Dividend rate |
|---|---|---|---|---|---|
| Allentown Portland Cement Co. (common)[32] | May 24 | ..... | 1½ | 3 | |
| Allentown Portland Cement Co. (6% bonds, 1932)[32] | May 24 | ..... | 87 | 92 | |
| Alpha Portland Cement Co. (common)[2] new stock | Oct. 10 | No par | 34 | 36 | 75c quar. July 15 |
| Alpha Portland Cement Co. (preferred)[2] | Oct. 10 | 100 | 115 | ..... | 1¾% quar. June 15 |
| American Lime and Stone Co. (7% bonds, 1942)[32] | May 24 | ..... | 39 | 39½ | |
| Arundel Corporation (sand and gravel—new stock) | Oct. 11 | No par | 44 | 44½ | 50c Oct. 1 |
| Atlantic Gypsum Products Corp. (1st 6's carrying 10 sh. com.)[10] | Oct. 13 | ..... | 118 | 122 | |
| Atlas Portland Cement Co. (common)[2] | Oct. 10 | No par | 40 | 43 | 50c qu. Sept. 1 |
| Atlas Portland Cement Co. (preferred) | ..... | 100 | ..... | ..... | 2% quar. Oct. 1 |
| Atlas Portland Cement Co. (preferred)[2] | Oct. 10 | 33⅓ | 43 | ..... | 2% quar. Oct. 1 |
| Beaver Portland Cement Co. (1st Mort. 7's)[5] | July 29 | 100 | 100 | 100 | |
| Bessemer Limestone and Cement Co. (Class A)[4] | Sept. 23 | ..... | 36 | 36¼ | 75c quar. Aug. 1 |
| Bessemer Limestone and Cement Co. (6½% bonds)[4] | Sept. 23 | ..... | 100 | 101 | |
| Boston Sand and Gravel Co. (common) | Oct. 7 | 100 | 80 | 82 | 1% qu., 2% ex. Jan. 1 |
| Boston Sand and Gravel Co. (preferred) | Oct. 8 | ..... | ..... | 85 | 1¾% quar. Jan. 1 |
| Boston Sand and Gravel Co. (1st preferred) | Oct. 8 | ..... | ..... | 90 | 2% quar. Jan. 1 |
| Canada Cement Co., Ltd. (common) | Oct. 11 | 100 | 242½ | ..... | 1½% quar. Oct. 17 |
| Canada Cement Co., Ltd. (preferred)[13] | Oct. 8 | 100 | 123 | 124 | 1¾% quar. Aug. 16 |
| Canada Cement Co., Ltd. (1st 6's, 1929)[11] | Oct. 8 | ..... | 101½ | 102½ | 3% semi-annual A&O |
| Canada Crushed Stone Corp., Ltd. (6½s, 1944)[11] | Oct. 8 | 100 | 96 | 99 | |
| Charles Warner Co. (lime, crushed stone, sand and gravel) | Oct. 10 | No par | 34½ | ..... | 50c Oct. 10 |
| Charles Warner Co. (preferred) | Oct. 10 | 100 | 107 | ..... | 1¾% quar. Oct. 27 |
| Cleveland Stone Co. (new stock) | Oct. 11 | ..... | 60 | 63 | |
| Connecticut Quarries Co. (1st Mortgage 7% bonds)[17] | Oct. 7 | 100 | 105 | ..... | 50c qu. June 15 |
| Consolidated Cement Corp. (1st Mort., 6½s, series A)[24] | Oct. 13 | 100 | 96 | 99 | |
| Consolidated Cement Corp. (5 yr. 6½% gold notes)[24] | Oct. 13 | 100 | 94 | 97 | |
| Consumers Rock and Gravel Co. (1st Mort. 7s)[18] | Oct. 7 | 100 | 100 | 101½ | |
| Coosa Portland Cement Co. (6% bonds, 1944)[32] | May 24 | ..... | 70 | ..... | |
| Coplay Portland Cement Co. (6% bonds, 1941)[32] | May 24 | ..... | 88 | ..... | |
| Dewey Portland Cement Co. (1st mort. 6's 1942)[30] | Oct. 13 | 100 | 99 | 100 | |
| Dolese and Shepard Co. (crushed stone)[7] | Oct. 13 | 50 | 100 | 103 | $1.50 July 1, $1 ex. July 1 |
| Egyptian Portland Cement Co. 7% pfd.[21] | Oct. 8 | ..... | 85 | 90 | 1¾% quar. July 1 |
| Egyptian Portland Cement Co. (common)[21] | Oct. 8 | ..... | 6 | 7½ | 40c quar. Oct. 1 |
| Fredonia Portland Cement Co. (6½% bonds, 1940)[32] | May 24 | ..... | 97 | 101 | |
| Giant Portland Cement Co. (common)[2] | Oct. 10 | 50 | 45 | 55 | |
| Giant Portland Cement Co. (preferred)[25] | Oct. 10 | 50 | 40 | 45 | 3½% June 15 |
| Ideal Cement Co. (common) | Sept. 27 | No par | 90 | 92 | $1 quar. Oct. 1 |
| Ideal Cement Co. (preferred)[33] | Oct. 10 | 100 | 111 | 112 | 1¾% quar. Oct. 1 |
| International Cement Corporation (common) | Oct. 11 | No par | 55½ | 56 | $1 quar. Sept. 30 |
| International Cement Corporation (preferred)[2] | Oct. 11 | 100 | 110 | 110 | 1¾% quar. Sept. 30 |
| Kelley Island Lime and Transport Co. | Oct. 11 | 100 | 183 | 185 | $2 quar., $2 ex. Oct. 1 |
| Lawrence Portland Cement Co.[2] | Oct. 10 | 100 | 97 | 101 | 2% quar. |
| Lehigh Portland Cement Co.[6] | Oct. 10 | 50 | 110 | 115 | 1½% quar. |
| Lyman Richey Sand and Gravel Co. (1st Mort. 6s, 1928 to 1931)[13] | Aug. 12 | 100 | 99½ | 100 | |
| Lyman Richey Sand and Gravel Co. (1st Mort. 6s, 1932 to 1935)[13] | Aug. 12 | 100 | 97½ | 99 | |
| Marblehead Lime Co. (1st Mort. 7's)[14] | Oct. 8 | 100 | 100 | ..... | |
| Marblehead Lime Co. (5½% notes)[14] | Oct. 8 | 100 | 98 | ..... | |
| Michigan Limestone and Chemical Co. (common)[6] | Oct. 10 | ..... | ..... | 26 | |
| Michigan Limestone and Chemical Co. (preferred)[6] | Oct. 10 | ..... | 24 | 26 | 1¾% quar. July 15 |
| Missouri Portland Cement Co. | Oct. 11 | 25 | 41 | 42 | 50c Aug. 1 |
| Monolith Portland Cement Co. (common)[9] | Oct. 1 | ..... | 12⅜ | 12¾ | 8% ann. Jan. 2 |
| Monolith Portland Cement Co. (units)[9] | Oct. 7 | ..... | 31 | 32½ | |
| Monolith Portland Cement Co. (preferred)[9] | Oct. 7 | ..... | 9⅜ | 9¾ | |
| National Gypsum Co. (common)[35] | Oct. 13 | ..... | 50 | 53 | |
| National Gypsum Co. (preferred)[35] | Oct. 13 | ..... | 82 | 85 | |
| National Gypsum Co. (pref. carrying acc. div.)[35] | Sept. 15 | ..... | 86 | 88 | |
| Nazareth Cement Co.[20] | Oct. 7 | No par | 32 | 34 | 75c quar. Apr. 1 |
| Newaygo Portland Cement Co.[1] | Sept. 23 | ..... | 110 | 110 | |
| Newaygo Portland Cement Co. (6½% bonds, 1938)[32] | May 24 | ..... | 100 | 102 | |
| New England Lime Co. (Series A, preferred)[14] | Oct. 8 | 100 | ..... | 95 | |
| New England Lime Co. (Series B, preferred)[22] | Sept. 26 | 100 | 97 | 99 | |
| New England Lime Co. (V.T.C.)[22] | Sept. 26 | ..... | 33 | 35 | |
| New England Lime Co. (6s, 1935)[14] | Oct. 8 | 100 | 98 | 100 | |
| New York Trap Rock Corp. (6% bonds, 1946)[32] | Oct. 11 | ..... | 100⅞ | 100⅞ | |
| North American Cement Corp. 6½s 1940 (with warrants) | Oct. 11 | 100 | 84 | 84½ | |
| North American Cement Corp. (units of 1 sh. pfd. plus ½ sh. common)[32] | Oct. 4 | ..... | 50 | 55 | 2 mo. period at rate of 7% |
| North American Cement Corp. (common)[19] | Apr. 9 | ..... | 8⅛ | 9 | |
| North American Cement Corp. (preferred) | Apr. 25 | ..... | ..... | ..... | 1.75 quar. Aug. 1 |
| North Shore Material Co. (1st Mort. 6's)[15] | Oct. 13 | 100 | 98½ | ..... | |
| Pacific Portland Cement Co. (common, new stock) | Oct. 7 | ..... | 25 | ..... | |
| Pacific Portland Cement Co., Consolidated[5] | Oct. 7 | 100 | 61¾ | ..... | 25c mo. |
| Pacific Portland Cement Co., Consolidated (preferred) | Oct. 10 | ..... | 81½ | 82 | |
| Pacific Portland Cement Co., Consolidated (secured serial gold notes)[5] | Oct. 7 | 100 | 98½ | ..... | 3% semi-annual Oct. 15 |
| Peerless Portland Cement Co.[1] | Sept. 23 | 10 | 5 | 5⅜ | |
| Pennsylvania-Dixie Cement Corp. (1st Mort. 6's)[29] | Oct. 11 | 100 | 99⅛ | 99⅛ | |
| Pennsylvania-Dixie Cement Corp. (preferred)[28] | Oct. 13 | 100 | 94½ | 95 | 1¾% Sept. 15 |
| Pennsylvania-Dixie Cement Corp. (common)[28] | Oct. 11 | ..... | 25 | 25⅜ | 50c Oct. 1 |
| Petoskey Portland Cement Co.[1] | Oct. 11 | 10 | 11 | 11½ | 1½% quar. |
| Pittsfield Lime and Stone Co.[31] | Oct. 8 | ..... | ..... | 100 | |
| Pittsfield Lime and Stone Co.[31] (common) | Oct. 8 | ..... | ..... | 25 | |

**(CONTINUED ON PAGE 82)**

[1]Quotations by Watling, Lerchen & Hayes Co., Detroit, Mich. Quotations by Bristol & Willett, New York. [3]Quotations by True, Webber & Co., Chicago. [4]Quotations by Butler, Beading & Co., Youngstown, Ohio. [5]Quotations by Freeman, Smith & Camp Co., San Francisco, Calif. [6]Quotations by Frederic H. Hatch & Co., New York. [7]Quotations by F. M. Zeiler & Co., Chicago, Ill. [8]Quotations by Ralph Schneeloch Co., Portland, Ore. [9]Quotations by A. E. White Co., San Francisco, Calif. [10]Quotations by Lee Higginson & Co., Boston and Chicago. [11]Nesbitt, Thomson & Co., Montreal, Canada. [12]E. B. Merritt & Co., Inc., Bridgeport, Conn. [13]Peters Trust Co., Omaha, Neb. [14]Second Ward Securities Co., Milwaukee, Wis. [15]Central Trust Co. of Illinois, Chicago. [16]J. S. Wilson, Jr., Co., Baltimore, Md. [17]Chas. W. Scranton & Co., New Haven, Conn. [18]Dean, Witter & Co., Los Angeles, Calif. [19]Hemphill, Noyes & Co., New York. [20]Quotations by Bond & Goodwin & Tucker, Inc., San Francisco. [21]Baker, Simonds & Co., Inc., New York. [22]William C. Simons, Inc., Springfield, Mass. [23]Blair & Co., New York and Chicago. [24]A. B. Leach and Co., Inc., Chicago. [25]A. C. Richards & Co., Philadelphia, Penn. [26]Hincks Bros. & Co., Bridgeport, Conn. [27]J. G. White and Co., New York. [28]Mitchell-Hutchins Co., Chicago, Ill. [29]National City Co., Chicago, Ill. [30]Chicago Trust Co., Chicago. [31]McIntyre & Co., New York. N. Y. [32]Hepburn & Co., New York. [33]Boettcher & Co., Denver, Colo. [34]Kidder, Peabody & Co., Boston, Mass. [35]Farnum, Winter and Co., Chicago. [36]Hanson and Hanson, New York.

# Editorial Comment

**On the Study of Geology**

An invitation to attend the annual geological field trip and conference of the Association of American State Geologists stirs us to comment on the very probable value of a study of geology on the part of the proprietors, executive officers and operating officials of *all* rock products plants. There was a time, in our locality at least, when the Chicago Geological Society was composed in considerable part of just such men—men who had a practical interest in geology as well as of men who have an academic interest in it.

Why has the local scientific society—the local geological society—gone out of style? They furnish a genuine opportunity for the layman to acquire useful scientific knowledge under the most favorable and pleasant auspices. A monthly meeting and an occasional field day to study geological formations firsthand would be most pleasurable and instructive. What quarry operator or sand and gravel operator would not enjoy his work and his visits to other plants the more if he had some general knowledge of the geology of the deposits he exploits?

Some people think that research implies a chemical laboratory and a whole catalog of scientific apparatus and instruments. It does not. Research is merely a *search for facts*, and the organization of the facts thus acquired for a useful purpose. Just as much useful research sometimes can be done by the plant owner or operator with a tin cup and a pail of water, or a small microscope, in these rock products industries as with the most complicated laboratory apparatus.

Let every owner of a limestone quarry first of all know his stone—its geological and physical characteristics. Let him know how to identify it both as the raw stone and as the finished lime. Let him take note how the characteristics observed are changed in making lime. Let him observe how the same kind of stone burned under different conditions in the kiln behaves—whether its characteristics are consistent under all conditions or under only special conditions. This is *fundamental* research in the lime industry—the very kind the lime industry needs most.

When various lime manufacturers have found out some of these things about their own stone and their own lime, they will be able to draw some conclusions—some generalizations. Then let them compare their conclusions with those of their associates in the lime industry. Discussions such as will grow out of these independent, homely researches will prove wonderfully interesting and instructive. Then the National Lime Association will have something tangible to work on, and lime manufacturers will have some comprehension of research work in general and of its immediate application to their individual problems.

A quarry face or a gravel pit to the uninitiated is little more than a hole in the ground. To one who has some knowledge of geology it is an open book, full of interesting things, and capable of furnishing much practical information—information that progressive producers can turn into profits. Let's all do a little "researching" and the sum total will make the quarry and gravel pit industries scientific and up-to-date branches of American industry instead of hit-and-miss and rule-of-thumb businesses.

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**Fighting Fire with Fire**

According to advices received from Detroit the recent cut of 15 cents in the price of portland cement is a step to show the people of the state of Michigan the absurdity of continuing the operation of the state cement plant at Chelsea. The state highway authorities are reported to have cancelled orders for 100,000 bbl. of cement placed with manufacturers in order to give the state plant something to do. The cut made by the manufacturers puts the price of cement below the price the state allows the convict-operated institution at Chelsea.

Last year, in spite of its cheap convict labor the state plant is reported to have had a deficit of $200,000, notwithstanding the fact that the state paid the prevailing market price—or claims to have paid the current price—for the state-made cement. Since January, 1927, it is said, the state cement plant deficit has increased to $800,000, which includes $100,000 for changes and improvements designed to modernize the mill.

Here then is a fine example to demonstate for all time that a publically-owned, politically-managed state enterprise cannot hope to compete with private enterprise. The state authorities cannot hide from the public the plant's costs. They can cut the price further if they so desire. The politicians are even now attempting to justify the operation of the plant for the higher priced product because the state has such an investment in it. Fine business! How many private concerns could operate on such a basis?

It is to be hoped that the price situation in Michigan will not affect business elsewhere. It is fighting fire with fire and may prove costly to both sides in the controversy. But politicians there and in other states can profit by the controversy. Their popularity with the public cannot long endure obvious wasting of the public's money—and here they have not the same opportunity of covering it up, that so often has saved their political hides.

## RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS (Continued)

| Stock | Date | Par | Price bid | Price asked | Dividend Rate |
|---|---|---|---|---|---|
| Riverside Portland Cement Co. | May 9 | ..... | 165 | ..... | 50c monthly, $1.50 e. Aug. 1 |
| Rockland and Rockport Lime Corp. (1st preferred)[34] | Oct. 7 | 100 | 101 | ..... | 3½% semi-annual Aug. 1 |
| Rockland and Rockport Lime Corp. (2nd preferred)[34] | Oct. 7 | 100 | 57 | 60 | 3% semi-annual Aug. 1 |
| Rockland and Rockport Lime Corp. (common)[34] | Oct. 7 | No par | ..... | 50 | 1½% quar. Nov. 2 |
| Sandusky Cement Co. (common)[1] | Aug. 2 | 100 | 125 | 135 | $2 qu. Oct. 1 |
| Santa Cruz Portland Cement Co. (bonds)[8] | Sept. 25 | ..... | 105 | ..... | 6% annual |
| Santa Cruz Portland Cement Co. (common)[8] | Oct. 7 | ..... | 85½ | ..... | $1 quar., $1 ex. Jan. 1 |
| Schumacher Wallboard Corp. (common) | Oct. 7 | ..... | 21¼ | 21⅞ | |
| Schumacher Wallboard Corp. (preferred) | Oct. 7 | ..... | 25½ | 26 | |
| Southwestern Portland Cement Co. (units) | May 11 | ..... | 205 | ..... | |
| Superior Portland Cement, Inc. (Class A)[30] | Oct. 7 | ..... | 50¼ | 51 | |
| Superior Portland Cement, Inc. (Class B)[30] | Oct. 7 | ..... | 37½ | 40 | |
| United Fuel and Supply Co. (sand and gravel) 1st Mort. 6s[27] | July 14 | 100 | 98 | 100 | |
| United Fuel and Supply Co. (sand and gravel) 6% gold notes[27] | July 14 | 100 | 98 | 100 | |
| United States Gypsum Co. (common) | Oct. 11 | 20 | 103 | 103½ | 40c quar. Sept. 30 |
| United States Gypsum Co. (preferred) | Oct. 10 | 100 | 120¼ | ..... | 1¾% quar. Sept. 30 |
| Universal Gypsum Co. (common)[3] | Oct. 13 | No par | 4 | 5 | |
| Universal Gypsum V.T.C.[3] | Oct. 13 | No par | 3½ | 4½ | |
| Universal Gypsum Co. (preferred)[3] | Aug. 31 | ..... | 40 | ..... | 1½% Feb 15 |
| Universal Gypsum and Lime Co. (1st 6's, 1946)[3] | Oct. 13 | 100 | 100 | 96 | |
| Union Rock Co. (7% serial gold bonds)[18] | Oct. 7 | ..... | Called as of Nov. 1, 1927 | | |
| Upper Hudson Stone Co. (1st 6's, 1951)[32] | May 24 | ..... | 93 | ..... | |
| Upper Hudson Stone Co. (1st 6's, 1937)[32] | May 24 | ..... | 104 | ..... | |
| Vulcanite Portland Cement Co. (7½% bonds, 1943)[32] | May 24 | 100 | 98½ | 101 | |
| Whitehall Cement Mfg. Co. (common)[36] | Oct. 7 | ..... | 150 | ..... | |
| Wisconsin Lime and Cement Co. (1st Mort. 6s, 1940)[15] | Oct. 13 | 100 | 99 | 101 | |
| Wolverine Portland Cement Co. | Oct. 11 | 10 | 6¾ | 6¾ | 15c quar. Aug. 15 |
| Yosemite Portland Cement Co. (Class B, common) | Oct. 11 | ..... | ..... | 5 | |

## QUOTATIONS OF INACTIVE ROCK PRODUCTS SECURITIES

| Stock | Date | Par | Price bid | Price asked | Dividend rate |
|---|---|---|---|---|---|
| Asbestos Corp. of Amer. (5 sh. pfd. and 5 sh. com.)[1] | June 22 | ..... | $1 for the lot | | |
| Atlanta Shope Brick and Tile Co.[1] | Nov. 24 | ..... | 25c | ..... | |
| Benedict Stone Corp. (cast-stone) (50 sh. pfd. and 390 sh. com.)[1] | Dec. 29 | ..... | $400 for the lot | ..... | |
| Blue Stone Quarry (60 shares)[2] | Mar. 16 | ..... | $10¼ for the lot | ..... | |
| Coplay Cement Mfg. Co. (common) (4) | Dec. 16 | ..... | 12½ | ..... | |
| Coplay Cement Mfg. Co. (preferred) (1) | Dec. 30 | ..... | 70 | ..... | |
| Eastern Brick Corp. (7% cu. pfd.) (1) | Dec. 9 | 10 | 40c | ..... | |
| Eastern Brick Corp. (sand lime brick) (common) (1) | Dec. 9 | 10 | 40c | ..... | |
| Edison Portland Cement Co. (common)[4] | Sept. 11 | 50 | 20c | ..... | |
| Edison Portland Cement Co. (preferred) | Nov. 3 | 50 | 17½c(x) | ..... | |
| International Portland Cement Co., Ltd. (preferred) | Mar. 1 | ..... | 30 | 45 | |
| Globe Phosphate Co. ($10,000 1st mtg. bonds, $169.80 per $1000 paid on prin.) | Dec. 22 | ..... | $50 for the lot | ..... | |
| Iroquois Sand and Gravel Co., Ltd. (2 sh. com. and 3 sh. pfd.) (1) | Mar. 17 | ..... | $12 for the lot | ..... | |
| Knickerbocker Lime Co.x | June 22 | ..... | 100 | ..... | |
| Limestone Products Corp. (150 sh. pfd., $50 par, and 150 sh. com., no par) | Dec. 22 | ..... | $60 for the lot | ..... | |
| Missouri Portland Cement Co. (serial bonds) | Dec. 31 | ..... | 104¾ | 104¾ | 3¼% semi-annual |
| Olympic Portland Cement Co. (g) | Oct. 13 | ..... | ..... | £1¾ | |
| Phosphate Mining Co. (3) | Nov. 24 | ..... | 1 | ..... | |
| River Feldspar and Milling Co. (50 sh. com. and 50 sh. pfd.) (1) | June 23 | ..... | $200 for the lot | | |
| Rockport Granite Co. (1st 6's, 1934)[2] | Aug. 31 | ..... | 90 | ..... | |
| Simbroco Stone Co.[2] | Apr. 20 | ..... | 12 | 12 | |
| Southern Phosphate Corp.[6] | Sept. 15 | ..... | 1¼ | ..... | |
| Tidewater Portland Cement Co. (3000 sh. com.) | Dec. 22 | ..... | $6525 for the lot | ..... | |
| Vermont Milling Products Co. (slate granules) 22 sh. com. and 12 sh. pfd. (6) | Nov. 3 | ..... | $1 for the lot | ..... | |
| Wabash Portland Cement Co.[1] | Aug. 3 | 50 | 60 | 100 | |
| Winchester Brick Co. (preferred) (sand lime brick) (5) | Dec. 16 | ..... | 10c | ..... | |

(g) Neidecker and Co., Ltd., London, England. (1) Price obtained at auction by Adrian H. Muller & Sons, New York. (2) Price obtained at auction by R. L. Day and Co., Boston. (3) Price obtained at auction by Weilepp-Bruton and Co., Baltimore, Md. (4) Price obtained at auction by Barnes and Lofland, Philadelphia, Pa. (5) Price obtained at auction for lot of 50 shares by R. L. Day and Co., Boston, Mass. (x) Price obtained at auction by Barnes and Lofland, Philadelphia, on November 3, 1925. (6) Price obtained at auction by Wise, Hobbs and Arnold, Boston, Mass.

## International Cement Net Ahead of 1926

WHILE cement companies generally may be experiencing a more or less unsatisfactory year, earnings of the International Cement Corp. continue to run somewhat ahead of 1926. Net for the third quarter shows improvement over last year's figures and with one month yet to be reported, net earnings for the quarter are expected to be in the neighborhood of $2.30 a share on the 562,500 shares of common outstanding. This would compare with net of $1,379,000 or $2.14 a share earned in the corresponding 1926 period.

Conservative estimates place net for the year at around $6.50 a common share, although it is admitted that should shipments continue to run ahead of 1926 in the final quarter as they are at the present time, earnings may more nearly approach the $7.04 a share earned in 1925. Last year, with a considerably larger capitalization than in 1925, net amounted to $4,355,000, equal to $6.16 a share. In the first half of the present year net of $2,048,000 or $3.04 a share was earned against $1,804,000 or $2.91 in the same period a year ago.

The importation of foreign cement along the Atlantic seaboard and quite extensive price cutting not only along the coast but also further inland has cut heavily into the earnings of cement companies and has prevented the International Cement Corp. from enjoying what it is believed would have been the best year in its history. As it is, the wide geographical diversification of mills of this company make it possible for good results to be obtained despite adverse conditions in some sectors. Foreign competition along the coast has become a factor that domestic manufacturers cannot overlook. With a wage scale of approximately one-fifth that paid here, foreign importers may advantageously compete for the domestic trade.

### *Added Capacity*

Additional facilities are being built at the three foreign mills of International in Cuba, Argentina and Uruguay which are expected to give an additional capacity of 1,000,000 bbl. a year. The new mill at New Orleans has been finished and in another six months will become one of the larger producers. All other 10 mills are operating satisfactorily.—*Wall Street News.*

## Yosemite Portland Plans Further Financing

YOSEMITE PORTLAND CEMENT CO., newest producer in California, will reopen its Merced plant next week after repairing damages suffered from a quarry blast, and will increase its capitalization from $3,500,000 to $4,000,000, it was announced recently.

The additional $500,000 in capital will be utilized for working capital, directors reported. The company is a Delaware corporation and its stock has a par value of $10. The new issue will be offered stockholders at par and if not absorbed will be offered later for public sale, according to A. Emory Wishon, president. Most of the stock is centered in the San Joaquin Valley.

The class B common stock is listed on the San Francisco curb market.

## Dividends Declared

| | Rate | Date Payable |
|---|---|---|
| Charles Warner Co. com. | 50c qu. | Oct. 10 |
| Charles Warner Co. pfd. | 1¾% qu. | Oct. 16 |
| Sandusky Coment Co. com. | $2 qu. | Oct. 1 |
| Consolidated Sand Co., Ltd. (Canada) pfd. | 1¾% qu. | Oct. 1 |

## New York State Stone Producers Cultivate Each Other

SOME 58 members and guests of the New York State Crushed Stone Association, on September 22, enjoyed what has come to be an annual institution of this association—a field day and general good time at the hunting lodge of J. L. Heimlich, president of the Le Roy Lime and Stone Co., Le Roy, N. Y. Aside from witnessing a shot at the Le Roy quarry and inspecting the two operations at Le Roy, the day was spent largely in learning anew that competitors are not such bad company as they sometimes appear to be. As we have said before, such occasions are quite as profitable to an association as the more serious sessions where problems and difficulties hold the first place on the program. The accompanying portrait of the host and two of his guests was taken by "Bill" Anderson, of the Hercules Powder Co., to whose hard work and genial personality much of the success of these meetings may be attributed.

## William Erdell Elected a Director of the Atlas Cement Co.

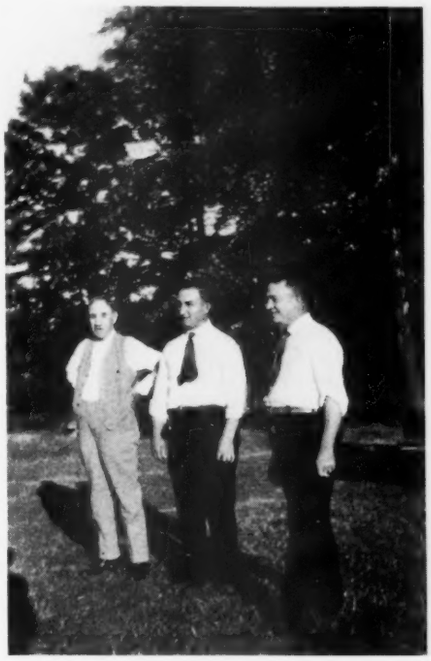
THE board of directors of the Atlas Portland Cement Co., at a meeting in New York City recently, elected William E. Erdell, of Allentown, Penn., to the board of directors of the company.

By the election of Mr. Erdell the Atlas company gets one of the most able cement men in the Lehigh district and one of the most widely known men in the entire cement industry.

Mr. Erdell's connection with the cement business goes back to the year 1888, when he was employed by the American Cement Co., now the Giant, at Egypt. In 1901 he became superintendent of the Whitehall Portland Cement Co. plant at Cementon and remained there until 1907, when he became associated with the Penn Allen Cement Co., remaining with that organization until it was sold to the Dexter Portland Cement Co. in January, 1926.

Since that time he has been devoting his attention to the construction of the Central Motoramp Garage, one of the very finest buildings of its kind in the country; to the development of his beautiful Raybelle Farm at Helfrich's Springs, and to activities in the Allentown hospital. He is a member of the building committee which is now constructing several fine units for that institution, and also of the executive committee. He was also the chairman of the executive committee in the recent successful hospital campaign, and both by his exceptional contributions of money, time and energy has shown his faith and interest in this important community asset.

Mr. Erdell's is a constructive mind which devotes itself to the solution of big problems. Thus in the construction of the Motoramp Garage he sought to provide a means for relieving traffic congestion in the heart of the city and also to afford a needed service along modern lines. In his work for the hospital he has worked along the broadest lines, and his courage, ability and foresight are reckoned among the most valuable assets in the group of business men who make up the hospital board. He has the public viewpoint, as illustrated not only



***Left to right—W. E. Foote, superintendent, Wickwire Limestone Co., Gasport, N. Y.; J. L. Heimlich, president Le Roy Lime and Stone Co., Le Roy, N. Y., and A. J. Hooker, sales manager, Buffalo Crushed Stone Co., Buffalo, N. Y.***

in his hospital work but also in his conversion of a fine part of his farm into a public picnic spot, while other public-spirited projects are being shaped by him for the future, according to his friends to whom he has confided and whose advice he has sought.

His re-entrance into the cement world can be expected to be marked by progressive aggressiveness, and the Atlas company is being congratulated on enlisting his interest. The Atlas company has 7 plants, located at Northampton and Coplay in this state; Hannibal, Mo., and Leeds, Ala. It has a subsidiary at Hudson, N. Y., while the Atlas Portland Cement Co. of Kansas owns and operates the plant of the Western States Portland Cement Co. at Independence, Kan. The annual production of the company is over 19,000,000 bbl.—*Allentown* (Penn.) *Chronicle and News.*

## Prof. Steinberg Leaves National Research Council

PROFESSOR S. S. STEINBERG of the University of Maryland, College Park, Md., has resigned his position as assistant director of the Highway Research Board of the National Research Council, Washington, D. C., and will resume his former position as head of the department of civil engineering at the university. Professor Steinberg will also practice as a consulting engineer on road and street construction. His office will be in College Park.

## W. D. Haden Company Buys Plant Site on Greens Bayou, Texas

W. D. HADEN CO., 2315 Polk street, Houston, have purchased a tract of 27 acres, fronting on Greens bayou, one-half mile from the Houston ship channel, from Judge R. E. Brooks for $21,000.

The Haden company, producers of sand, gravel and shell, plans the establishment of an unloading plant on the property, and will bring large shell barges up the ship channel to the mouth of Greens bayou, thence up that stream to the unloading plant, from where it will be shipped by the new interurban line of the Missouri Pacific to Houston to be used in local building operations. —*Houston* (Tex.) *Dispatch.*

## South Carolina Importing Norwegian Cement

WHILE something of a controversy is reported to be in progress concerning the use of foreign cement in South Carolina road construction, a cargo of 14,000 bags of this product, imported from Brebik, Norway, was discharged recently at the port terminals at Charleston, S. C.

Certain members of the state highway commission contend that foreign cement is available at a lower cost than the domestic product, making it, they declare, more economical to use the imported product. Others, however, have made known their opposition to the practice of importation.—*Durham* (N. C.) *Herald.*

## Manufacturers' Division Meeting of Crushed Stone Association

THE annual pre-convention dinner meeting of the Manufacturers' Division of the National Crushed Stone Association will be held at the Commodore Hotel, New York City, on Friday, October 21, at 6 p. m. Gordon Buchanan, president of the C. G. Buchanan Co., Inc., 90 West St., New York City, is chairman of the committee on arrangements.

Several matters of very great importance to the association will come up for discussion and action at this meeting. Plans for making the Manufacturers' Division Exposition the largest and most successful ever held will be determined upon. The president, executive committee, director of the bureau of engineering, and secretary of the National Crushed Stone Association will be present.

## More Developments in Portland Cement Rumored

MYSTERIOUS purchasers of limestone quarry property in the Catskill, N. Y., and Sandusky, Ohio, portland-cement producing regions are giving rise to quarry rumors. It may be, of course, that present producers are merely acquiring reserve limestone deposits. These rumors are repeated, merely for what they are worth—evidences of continued activity in portland cement projects.

The *Catskill Mail* carries the following item:

"That another large cement plant will be erected in the town of Catskill in the near future, is indicated by recent activities here in obtaining options on several parcels of lands in this vicinity.

"For some time Decker & Malcolm, attorneys, have been assisting in obtaining options on land in this town, on which there is cement rock. This firm represented B. L. Miller of Bethlehem. Options on approximately 1,500 acres of land were obtained and were filed yesterday afternoon in the Greene County Clerk's Office here.

"The land on which options were obtained includes the George W. Holdridge stone quarry and other parcels from there to the Mildred Hayner farm and all the land between, to the Hudson River.

"Although Mr. Miller would not say whom he represented, he declared that it was reasonably sure a cement plant would be erected here in the near future. From another source, however, it was learned that the parties for whom the options were obtained have two or three large cement mills in operation at present.

"It is said that there is plenty of cement rock on the properties on which options were obtained, to last for many years. This, with the excellent shipping facilities available here, is one of the reasons why the firm desires to build a mill in Catskill. Another element that enters into the proposition is the fact that a large sum annually can be saved on freight rates on cement manufactured and shipped from Pennsylvania to points in New York State.

"No definite information is available at present. P. W. Decker, of the firm of Decker & Malcolm, who represented Mr. Miller in procuring the options and looking after the legal formalities, said today he did not know what cement men were behind the project, but he had been assured that it was almost certain that a mill would be built here. It is expected that something more definite as to the project will be available soon."

A recent Sandusky dispatch to various Cleveland newspapers states:

"Much mystery surrounds the buying by one G. W. Woolford of Upper Sandusky of valuable farm lands in Margaretta and Perkins townships near this city.

"An investigation by business interests today disclosed that Mr. Woolford is acting for William F. Reile, president of the First National Bank of Upper Sandusky, but nothing more. Mr. Reile, it is understood, is acting for other parties.

"The land bought is rich in stone and visions of another quarry industry consequently arise. The August and Christian Kuebler, Pfaff, Graves, Mettler, Robert A. Tierney, Charles F. Steen and Adolph Riedy farms have been purchased at prices ranging from $150 to $200 an acre and negotiations are pending for a number of others. In all, close to 2500 acres of land have been bought up."

## Bruns Hydrated Lime Co.'s New Plant in Operation

THE new six-kiln lime plant of the Bruns Hydrated Lime Co., Woodville, Ohio, was recently completed and put in operation. Initial capacity is given as about 75 tons of burned lime per day. The plant was designed and built by Arnold & Weigel, Woodville.

Charles Kaemming is president of the Bruns Hydrated Lime Co.; Frank Siegenthaler, vice president, and C. C. Robinson, secretary.

## Mathieson Alkali Works to Build New Cement Mill

ACCORDING to official sources the Mathieson Alkali Works, Inc., 250 Park Ave., New York City, N. Y., is arranging to build a portland cement plant in connection with its general operations, and has selected a tract of land at its soda ash plant at Saltville, Va., as the site for a new cement mill, for which plans will be completed soon. It will be equipped for an initial output of about 1,000,000 bbl. per annum, and is reported to cost close to $2,000,000 with machinery. Plans for a general expansion and improvement program at the Saltville alkali plant, including the installation of equipment for replacement of obsolete machinery and for increase in former output, are also in progress, according to the report.

## Missouri Cement Outlook Good

PRESENT indications are that September sales for Missouri Portland Cement Co. will be about the same as those of August and exceed those of last September by about 23%, it was stated recently by H. L. Block, president of the Missouri company, according to the *St. Louis* (Mo.) *Globe-Democrat*.

"We look for our October business to exceed that of last October unless weather unfavorable to general building and road construction should prevail," he said.

"The sales of Velo cement (which becomes as hard in 24 hours as regular portland cement does in 28 days) continue to increase, and in order to supply the demand, pending completion of the new plant the company is building for the manufacture of approximately 2000 bbl. of Velo cement per day, a quantity is being manufactured in the Red Ring mill at Prospect Hill, St. Louis county. It is expected the new mill for the exclusive manufacture of Velo cement will be in operation early in the season of 1928.

"We look for good business for the balance of the year."

***New plant of the Bruns Hydrated Lime Co. at Woodville, Ohio***

## D. C. Souder, Chairman, Quarry Section, N. S. C.

D. C. SOUDER, director, insurance and safety, of the France Stone Co., Toledo, Ohio, who was elected chairman of the Quarry Section, National Safety Congress, at the recent Chicago convention, has the distinction of being the first officer of a

*Don C. Souder*

commercial crushed-stone organization to devote his whole time to accident prevention and insurance work. He has been employed in that capacity by the France Stone Co. for a number of years and is one of the organizers of the Quarry Section of the N. S. C. He has been through all "the chairs" of the section from secretary, vice-chairman, to present chairman.

## New British Eastwoods Cement Co., Ltd., Now Producing

THE second ordinary general meeting was held on September 20, the chairman, Horace Boot, presiding. One kiln with a capacity of 50,000 to 60,000 tons of cement per annum had been working since July on trial tests making cement, and will be officially opened at the end of October. Several thousands of tons of cement had been made of a quality superior to the British standard specification, and a number of sales at market prices had taken place. The effect of the general and coal strikes postponed the date for reaching the production stage by several months. The company had given its contracts for the plant and machinery to only first-class British manufacturers. The profit and loss account showed an excess of income over expenditure of £1602, which with £652 brought forward from last year, made a surplus of £2255. The overhead expenses would always be small owing to the close relationship with Eastwoods, Ltd., which gave them the use of their head office premises and the benefit of the services of their staff. When their works were completed, the company would have some of the finest machinery and plant obtainable, and in spite of this the capital cost per ton of cement output would be one of the lowest, if not the lowest, in the kingdom. All the machinery was driven by electricity generated in the company's own power station.—*Chemisty and Industry* (London, England).

## Limestone Company Seeks to Prevent Removal of Coal

A BILL for an injunction to restrain the Annandale Coal Co. from removing coal underlying limestone of the Pittsburgh Limestone Co., near Annandale, has been filed in Butler county, Penn., courts.

The Annandale Coal Co. is mining a 4-ft. vein of coal in the northern section of Butler county, and has under lease or owns a large acreage of coal. The Pittsburgh Limestone Co. owns the limestone of a 24-ft. vein. This limestone vein is 55 ft. above the 4-ft. coal vein.

The Pittsburgh company contends that if the Annandale Coal Co. removes the coal from under the limestone the entire strata above will subside and the drop will cause the large vein of limestone, which is of tremendous weight, to shatter. They further contend that shattered limestone is impossible to be mined and that if the coal company is permitted to remove the coal their limestone will be of no value and the extensive and expensive operation useless.

The limestone company alleges that it has spent about $700,000 in development.

## Florida Limestone Production Shows Increase

ACCORDING to figures announced by Herman Gunter, state geologist of Florida, the production and valuation of crushed limestone in that state were nearly double in 1926 what they were in 1925. The figures given out by Mr. Gunter on the production and valuation of crushed limestone were for 1926, a production of 6,572,870 short tons, valued at $7,177,565, and 3,795,420 short tons in 1925, valued at $4,348,234.

## E. E. Evans Made Chairman of Quarry Section of Ohio Safety Congress

E. E. EVANS of Toledo, president of the Ohio Crushed Stone Association, has been made chairman of the mining and quarries section of the Ohio Safety Congress to be held in Columbus, November 9 and 10, under the auspices of the Ohio Industrial Commission.

## Marquette Cement Company to Enlarge LaSalle Mill

PLANS have already been completed and work actually started on enlarging the plant of the Marquette Cement Manufacturing Co. at La Salle, Ill. The expansion will consist of an addition to the present plant which will hold a new kiln, 10x100 ft. in size. It is expected that the installation of the new kiln and other improvements will increase the capacity of the mill, which now produces nearly 3,000,000 bbl. yearly, by more than 500,000 bbl.

Among other improvements, the Marquette company is installing new Traylor compeb mills on the raw side of its mill. Steel has already been ordered for the new addition, and it is expected that the new kiln will be in production by June, 1928.

## Midland Sand and Gravel Co. Opens Pit in Southern Texas

A NEW gravel plant which will serve the Rio Grande valley in Texas has recently been opened at Twin Oaks, Tex., in Live Oak county, by the Midland Sand and Gravel Co. of Terrell, Tex. The new pit will produce only washed and graded gravel and sand, and the new screening plant has already been installed and placed in operation. The Twin Oaks plant is adjacent to the S. A. U. and G. railroad. It is expected that much of the material from the pit will be shipped to Corpus Christi, Tex., and the south Texas office of the company has already been opened in the Nixon building in that city to care for the Rio Grande business. L. W. Wells, Jr., is president and J. G. Wells is in charge at Corpus Christi.

*E. E. Evans*

# Portland Cement Output in September

## Production and Shipments Continue at High Rate—Shipments for Nine Month Period Exceed 1926 Figures by Nearly 7%

SEPTEMBER, 1927, production and shipments of portland cement were at nearly the record high rate set in August and were nearly 6 and 10%, respectively, greater than in September a year ago, according to the Bureau of Mines, Department of Commerce. Portland cement stocks are still diminishing and are slightly under those on September 30, 1926.

During the nine months ending September 30, shipments amounted to 134,981,000 bbl., surpassing the shipments in the corresponding period in 1926 by nearly 7%.

The output of another new plant, located in California, is included in these statistics, which are compiled from reports for September, 1927, received direct from all manufacturing plants except two, for which estimates are necessary on account of lack of returns.

### *Clinker Stocks*

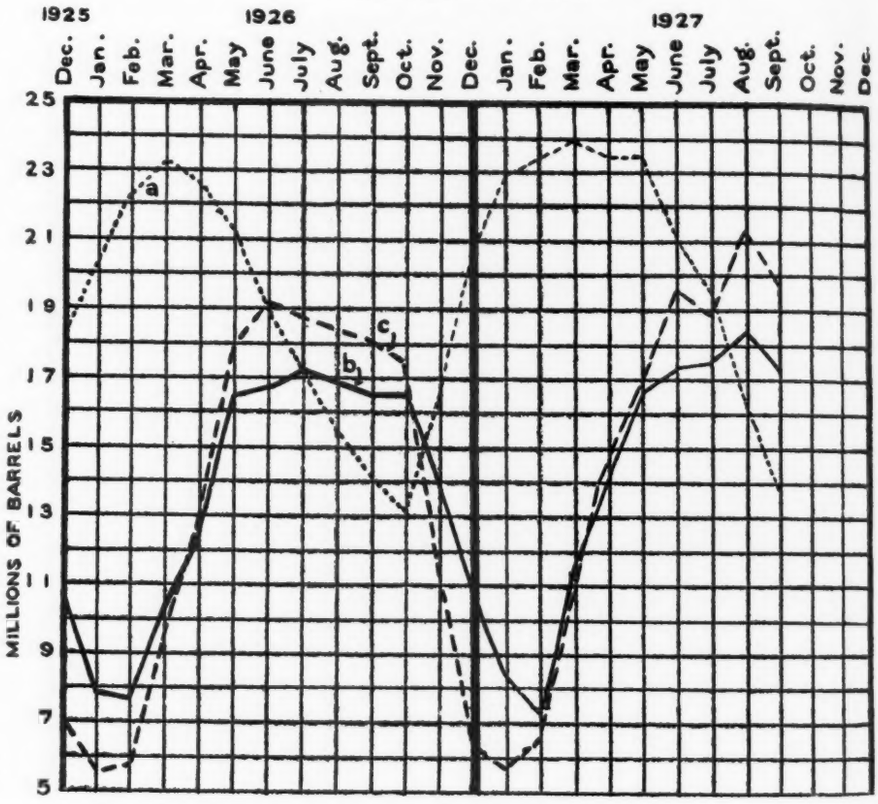
Stocks of clinker, or unground cement, at the mills at the end of September, 1927, amounted to about 6,459,000 bbl. compared with 7,887,000 bbl. (revised) at the beginning of the month.

ESTIMATED CLINKER (UNGROUND CEMENT) AT THE MILLS AT END OF EACH MONTH, 1926 AND 1927, IN BARRELS

| Month | 1926 | 1927 |
|---|---|---|
| January | 9,074,000 | 9,989,000 |
| February | 10,931,000 | 11,943,000 |
| March | 12,290,000 | 12,997,000 |
| April | 12,967,000 | 13,335,000 |
| May | 11,695,000 | 12,514,000 |
| June | 10,144,000 | 10,926,000 |
| July | 8,604,000 | 9,609,000 |
| August | 7,362,000 | *7,887,000 |
| September | 6,112,000 | 6,459,000 |
| October | 5,370,000 | |
| November | 5,748,000 | |
| December | 7,799,000 | |

*Revised.

MONTHLY FLUCTUATION IN PRODUCTION, SHIPMENTS AND STOCKS OF FINISHED PORTLAND CEMENT




***(a) Stocks of finished portland cement at factories; (b) Production of finished portland cement; (c) Shipments of finished portland cement from factories***

### *Distribution of Cement*

The following figures show shipments from portland cement mills distributed among the states to which cement was shipped during July and August, 1926 and 1927.

PORTLAND CEMENT SHIPPED FROM MILLS INTO STATES, IN JULY AND AUGUST, 1926 AND 1927, IN BARRELS*

| Shipped to— | 1926—July | 1927 | 1926—August | 1927 |
|---|---|---|---|---|
| Alabama | 184,577 | 207,386 | 173,619 | 243,841 |
| Alaska | 1,386 | 2,029 | 1,130 | 338 |
| Arizona | 35,817 | 38,125 | 45,553 | 34,598 |
| Arkansas | 73,292 | 72,502 | 71,312 | 85,164 |
| California | 1,173,099 | 1,077,710 | 1,165,387 | 1,158,661 |
| Colorado | 117,990 | 113,490 | 133,172 | 124,628 |
| Connecticut | 218,375 | 258,232 | 224,946 | 239,392 |
| Delaware | 38,228 | 18,765 | 35,287 | 40,815 |
| District of Columbia | 94,852 | 105,400 | 75,684 | 103,217 |
| Florida | 284,281 | 166,647 | 330,285 | 180,328 |
| Georgia | 213,432 | 179,713 | 188,201 | 193,713 |
| Hawaii | 12,761 | 34,500 | 8,895 | 28,219 |
| Idaho | 47,991 | 28,166 | 44,589 | 30,009 |
| Illinois | 1,857,871 | 1,962,942 | †1,806,446 | 2,066,172 |
| Indiana | 698,427 | 771,651 | †702,574 | 868,669 |
| Iowa | 353,529 | 486,109 | 412,046 | 602,653 |
| Kansas | 230,022 | 263,430 | 260,169 | 251,022 |
| Kentucky | 200,154 | 239,555 | †175,705 | 283,184 |
| Louisiana | 112,958 | 147,449 | 121,260 | 147,709 |
| Maine | 67,475 | 82,034 | 108,161 | 81,018 |
| Maryland | 221,600 | 272,142 | 208,790 | 366,046 |
| Massachusetts | 331,320 | 290,232 | 349,319 | 314,527 |
| Michigan | 1,504,056 | 1,360,516 | †1,570,296 | 1,788,820 |
| Minnesota | 475,846 | 419,976 | 437,014 | 480,599 |
| Mississippi | 89,752 | 102,252 | 80,109 | 111,007 |
| Missouri | 653,615 | 481,281 | 611,020 | 560,364 |
| Montana | 38,749 | 39,521 | 31,256 | 50,776 |
| Nebraska | 172,489 | 150,181 | 201,211 | 180,063 |
| Nevada | 7,873 | 10,139 | 9,088 | 6,149 |
| New Hampshire | 55,233 | 50,796 | 49,958 | 56,223 |
| New Jersey | 793,625 | 844,190 | 691,453 | 853,588 |
| New Mexico | 14,736 | 18,160 | 21,231 | 23,750 |
| New York | 2,336,788 | 2,467,699 | 2,329,217 | 2,749,722 |
| North Carolina | 396,618 | 321,348 | 376,779 | 340,093 |
| North Dakota | 62,581 | 71,813 | 43,493 | 69,872 |
| Ohio | 1,272,308 | 1,166,296 | †1,235,463 | 1,381,581 |
| Oklahoma | 205,345 | 287,638 | 236,223 | 298,452 |
| Oregon | 151,296 | 187,401 | 128,525 | 188,586 |
| Pennsylvania | 1,618,569 | 1,573,559 | 1,493,733 | 1,706,430 |
| Porto Rico | 0 | 3,000 | 0 | 3,500 |
| Rhode Island | 65,525 | 69,599 | 66,573 | 85,312 |
| South Carolina | 53,506 | 63,414 | 62,408 | 103,455 |
| South Dakota | 46,987 | 50,896 | 44,054 | 50,994 |
| Tennessee | 213,058 | 269,184 | 207,528 | 285,835 |
| Texas | 481,008 | 436,475 | 484,822 | 533,591 |
| Utah | 50,306 | 41,478 | 54,276 | 60,332 |
| Vermont | 38,607 | 45,365 | 49,660 | 67,255 |
| Virginia | 180,085 | 195,133 | 182,011 | 211,679 |
| Washington | 239,146 | 299,400 | 198,993 | 335,681 |
| West Virginia | 214,948 | 194,693 | †162,494 | 239,578 |
| Wisconsin | 704,770 | 858,526 | 715,784 | 1,035,131 |
| Wyoming | 19,973 | 20,374 | 24,901 | 22,131 |
| Unspecified | 599 | 29,843 | †70,233 | 23,887 |
| | 18,727,439 | 18,948,355 | †18,512,336 | 21,348,350 |
| Foreign countries | 84,561 | 35,645 | 70,664 | 62,650 |
| Total shipped from cement plants | 18,812,000 | 18,984,000 | 18,583,000 | 21,411,000 |

*Includes estimated distribution of shipments from three plants in July and August, 1927; and from five plants in July and August, 1926.
†Revised.

### *Relation of Production to Capacity*

Review of estimates published a month ago has been made in the light of the record of monthly production of the individual cement plants in 1926 and 1927, resulting in material upward revision of the estimates. The capacity demonstrated by rates of production sustained over continuous periods of three months by each of the plants indicates a total capacity for the year 1926 of at least 215,300,000 bbl. Since January 1, 1927, new plants and extensions and betterments in old plants have raised the capacity on August 31, 1927, to at least 228,300,000 bbl. a year and on September 30, 1927, to at least 229,020,000 bbl. On the basis of these revised estimates the 1926 production amounted to 76.4% of capacity, the August, 1927, output represented approximately 94.4% of the capacity of the plants for that month, and the production for the first 8 months of the year was 75.2% of the capacity available during that period. Corresponding figures for September and for the first 9 months of the year are 92.2% and 77.2%, respectively.

IMPORTS OF HYDRAULIC CEMENT BY COUNTRIES AND BY DISTRICTS, IN AUGUST, 1927

| Imported from | District into which imported | Barrels | Value |
|---|---|---|---|
| Belgium | Florida | 24,490 | $29,535 |
| | Maine and New Hampshire | 3,000 | 3,648 |
| | Massachusetts | 47,091 | 73,447 |
| | New Orleans | 3,000 | 3,685 |
| | New York | 200 | 370 |
| | Oregon | 3,000 | 4,061 |
| | Porto Rico | 2,585 | 4,965 |
| | Washington | 7,339 | 9,753 |
| | Total | 90,705 | $129,464 |
| Canada | Alaska | 5 | $25 |
| | Maine and New Hampshire | 1,018 | 2,329 |
| | Saint Lawrence | 3,250 | 6,740 |
| | Total | 4,273 | $9,094 |
| Chile | New York | 6 | $10 |
| Denmark | New York | 751 | $2,998 |
| | Porto Rico | 2,993 | 4,564 |
| | Total | 3,744 | $7,562 |
| Norway | Los Angeles | 500 | $581 |
| | New York | 872 | 1,331 |
| | Philadelphia | 12,000 | 14,166 |
| | Virginia | 25 | 46 |
| | Total | 13,397 | $16,124 |
| United K'gd'm | New York | 1,489 | $3,270 |
| | Porto Rico | 3,991 | 4,643 |
| | Total | 5,480 | $7,913 |
| | Grand total | 117,605 | $170,167 |

### *Exports and Imports**

EXPORTS OF HYDRAULIC CEMENT BY COUNTRIES IN AUGUST, 1927

| Exported to— | Barrels | Value |
|---|---|---|
| Canada | 2,274 | $10,476 |
| Central America | 2,695 | 8,847 |
| Cuba | 7,137 | 19,863 |
| Other West Indies | 9,599 | 17,815 |
| Mexico | 4,444 | 13,875 |
| South America | 27,401 | 96,264 |
| Other countries | 7,821 | 42,058 |
| | 61,371 | $209,198 |

DOMESTIC HYDRAULIC CEMENT SHIPPED TO ALASKA, HAWAII, AND PORTO RICO, IN AUGUST, 1927*

| | Barrels | Value |
|---|---|---|
| Alaska | 2,060 | $ 6,307 |
| Hawaii | 34,792 | 92,256 |
| Porto Rico | 6,580 | 17,171 |
| | 43,432 | $115,734 |

*Compiled from the records of the Bureau of Foreign and Domestic Commerce and subject to revision.

## New Texas Graphite Plant

PRACTICALLY completed at a cost of $300,000, the new Souhwestern Consolidated Graphite Co. mill at Burnet, Texas, represents the latest and most modern practice in the production of graphite, according to B. M. Snyder, general manager of the Southwestern Engineering Corp., designers and builders of the plant.

Economy and refinements in metallurgy are features of the mill, and it is expected that operating costs will be considerably under those of former methods. The new plant, occupying one-half the area of the old six-story mill, but with double the capacity, is one of the finest graphite concentrating plants in the world, Mr. Snyder explained.

This graphite deposit in Texas has been worked for the last 10 or 12 years and runs from 100 to 150 ft. in width. Electrostatic separation and air sizing was used until about 1921, when flotation was adopted.

The design for the new mill is the result of a large number of tests carried out in the laboratories of the engineering company in Los Angeles. Steel and reinforced concrete construction was used throughout and all recognized safety devices have been installed.

The ore is delivered by five-ton side-dump trucks to the crushing plant, which has a capacity of 50 tons per hour. Following crushing and fine grinding, a flexible arrangement in the flotation division, where flotation machines have been installed, permits any one of four treatments, all having certain advantages according to the product desired. Marketable graphite will be the product direct from flotation. Special dewatering, filtering and drying equipment have been incorporated in the mill construction.—*Los Angeles* (Calif.) *Examiner.*

PRODUCTION, SHIPMENTS, AND STOCKS OF FINISHED PORTLAND CEMENT, BY MONTHS, IN 1926 AND 1927, IN BARRELS

| Month | 1926—Production | 1927 | 1926—Shipments | 1927 | Stocks at end of month 1926 | 1927 |
|---|---|---|---|---|---|---|
| January | 7,887,000 | 8,258,000 | 5,674,000 | 5,968,000 | 20,582,000 | 22,914,000 |
| February | 7,731,000 | 7,377,000 | 5,820,000 | 6,731,000 | 22,385,000 | 23,560,000 |
| March | 10,390,000 | 11,452,000 | 9,539,000 | 11,083,000 | 23,236,000 | 23,922,000 |
| First quarter | 26,008,000 | 27,087,000 | 21,033,000 | 23,782,000 | ..... | ..... |
| April | 12,440,000 | 14,048,000 | 12,965,000 | 14,350,000 | 22,710,000 | 23,654,000 |
| May | 16,510,000 | 16,701,000 | 17,973,000 | 16,865,000 | 21,255,000 | 23,503,000 |
| June | 16,866,000 | 17,224,000 | 19,134,000 | 19,761,000 | 19,000,000 | 20,972,000 |
| Second quarter | 45,816,000 | 47,973,000 | 50,072,000 | 50,976,000 | ..... | ..... |
| July | 17,134,000 | *17,408,000 | 18,812,000 | 18,984,000 | 17,301,000 | 19,397,000 |
| August | 16,995,000 | *18,315,000 | 18,583,000 | 21,411,000 | 15,718,000 | *16,292,000 |
| September | 16,571,000 | 17,492,000 | 18,087,000 | 19,828,000 | 14,188,000 | 13,956,000 |
| Third quarter | 50,700,000 | 53,215,000 | 55,482,000 | 60,223,000 | ..... | ..... |
| October | 16,596,000 | ..... | 17,486,000 | ..... | 13,334,000 | ..... |
| November | 14,193,000 | ..... | 11,276,000 | ..... | 16,243,000 | ..... |
| December | 10,744,000 | ..... | 6,432,000 | ..... | 20,616,000 | ..... |
| Fourth quarter | 41,533,000 | ..... | 35,194,000 | ..... | ..... | ..... |
| | 164,057,000 | ..... | 161,781,000 | ..... | ..... | ..... |

*Revised.

PRODUCTION, SHIPMENTS, AND STOCKS OF FINISHED PORTLAND CEMENT, BY DISTRICTS, IN SEPTEMBER, 1926 AND 1927, AND STOCKS IN AUGUST, 1927, IN BARRELS

| Commercial district | Production 1926—Sept. | 1927 | Shipments 1926—Sept. | 1927 | Stocks at end of 1926—Sept. | 1927 | Stocks at end of Aug., 1927* |
|---|---|---|---|---|---|---|---|
| East'n Penn., N. J. & Md. | 3,936,000 | 4,058,000 | 4,593,000 | 4,596,000 | 2,718,000 | 3,469,000 | 4,007,000 |
| New York | 948,000 | 1,273,000 | 1,194,000 | 1,468,000 | 596,000 | 1,170,000 | 1,365,000 |
| Ohio, W. Penn. & W. Va. | 1,797,000 | 1,804,000 | 1,903,000 | 2,352,000 | 1,930,000 | 1,734,000 | 2,284,000 |
| Michigan | 1,415,000 | 1,692,000 | 1,614,000 | 1,869,000 | 1,062,000 | 1,080,000 | 1,257,000 |
| Wis., Ill., Ind., and Ky. | 2,326,000 | 2,472,000 | 2,451,000 | 2,564,000 | 1,792,000 | 1,139,000 | 1,231,000 |
| Va., Tenn., Ala., Ga., & La.† | 1,368,000 | 1,458,000 | 1,428,000 | 1,490,000 | 1,029,000 | 1,114,000 | 1,145,000 |
| E. Mo., Ia., Minn. & S. D. | 1,470,000 | 1,481,000 | 1,556,000 | 2,014,000 | *1,992,000 | 1,204,000 | 1,737,000 |
| W. Mo., Neb., Kan. & Okla. | 1,046,000 | 1,033,000 | 970,000 | 1,187,000 | 1,407,000 | 1,312,000 | 1,466,000 |
| Texas | 437,000 | 487,000 | 438,000 | 466,000 | 417,000 | 272,000 | 251,000 |
| Colo., Mont. & Utah | 247,000 | 174,000 | 288,000 | 249,000 | 384,000 | 384,000 | 458,000 |
| California | 1,272,000 | 1,200,000 | 1,318,000 | 1,214,000 | 458,000 | 704,000 | 718,000 |
| Oregon & Washington | 309,000 | 360,000 | 334,000 | 359,000 | *403,000 | 374,000 | 373,000 |
| | 16,571,000 | 17,492,000 | 18,087,000 | 19,828,000 | 14,188,000 | 13,956,000 | 16,292,000 |

*Revised. †Began producing June, 1927, and shipping July, 1927.

EXPORTS AND IMPORTS OF HYDRAULIC CEMENT, BY MONTHS, IN 1926 AND 1927

| | Exports 1926 Barrels | 1926 Value | 1927 Barrels | 1927 Value | Imports 1926 Barrels | 1926 Value | 1927 Barrels | 1927 Value |
|---|---|---|---|---|---|---|---|---|
| January | 72,939 | $216,431 | 75,346 | $254,072 | 360,580 | $576,600 | 193,175 | $269,661 |
| February | 73,975 | 220,706 | 71,404 | 233,985 | 308,161 | 527,948 | 130,421 | 200,680 |
| March | 69,080 | 205,647 | 67,956 | 240,165 | 493,241 | 812,968 | 181,146 | 261,519 |
| April | 96,296 | 284,772 | 72,383 | 243,832 | 257,302 | 398,114 | 191,868 | 313,262 |
| May | 78,601 | 224,365 | 59,332 | 205,574 | 223,130 | 337,031 | 178,929 | 263,618 |
| June | 80,684 | 248,814 | 69,205 | 237,281 | 323,656 | 495,744 | 129,111 | 201,682 |
| July | 130,822 | 370,220 | 72,337 | 229,737 | 250,862 | 395,981 | 175,035 | 249,665 |
| August | 64,946 | 216,499 | 61,371 | 209,198 | 350,638 | 560,532 | 117,605 | 170,167 |
| September | 70,920 | 239,174 | ..... | ..... | 194,129 | 308,224 | ..... | ..... |
| October | 69,389 | 225,874 | ..... | ..... | 263,403 | 386,335 | ..... | ..... |
| November | 76,698 | 238,103 | ..... | ..... | 55,225 | 82,949 | ..... | ..... |
| December | 89,976 | 305,238 | ..... | ..... | 152,059 | 242,974 | ..... | ..... |
| | 974,326 | $2,995,833 | ..... | ..... | 3,232,386 | $5,125,400 | ..... | ..... |

## Sand-Lime Brick Production and Shipments in September

THE following data are compiled from report received direct from 23 producers of sand-lime brick located in various parts of the United States and Canada. The number of plants reporting is two less than those furnishing statistics for the August estimate published in the September 17 issue. The statistics below may be regarded as representative of the entire industry, the reporting plants having about one-half the production capacity in the United States and Canada:

Production and shipments showed a considerable decrease in September from the high August figures. Prices quoted by producers at different points remain practically the same as those given for the month of August. As the end of the season approaches, the number of unfilled orders has decreased, while at the same time stocks on hand are larger than for August.

The following are average prices quoted for sand-lime brick in September:

***Average Prices for September***

| Shipping Point | Plant Price | Delivered |
|---|---|---|
| Albany, Ga. | $10.00 | $ ..... |
| Atlantic City, N. J. | 14.00 | ..... |
| Dayton, Ohio | 12.00 | 15.00 |
| Detroit, Mich. | ..... | 16.00 |
| Detroit, Mich. | 13.50 | 16.00 |
| Detroit, Mich. | 12.50 | 15.00 |
| Grand Rapids, Mich. | 12.50 | ..... |
| Hartford, Conn. | 14.00 | ..... |
| Hummelstone, Penn. | 10.50 | ..... |
| Jackson, Mich. | 12.25 | ..... |
| Madison, Wis. | 12.50 | ..... |
| Menominee, Mich. | 11.00 | 14.50 |
| Michigan City, Ind. | 11.00 | ..... |
| Milwaukee, Wis. | 10.50 | 13.00 |
| Plant City, Fla. | 10.00@11.00 | ..... |
| Pontiac, Mich. | 13.00 | 15.00 |
| Rochester, N. Y. | ..... | 19.75 |
| Saginaw, Mich. | 12.50 | ..... |
| Sebewaing, Mich. | ..... | ..... |
| Sioux Falls, S. D. | 12.00 | ..... |
| Syracuse, N. Y. | 18.00 | 20.00 |
| Toronto, Can. | 13.50 | 16.00 |
| Woburn, Mass. | ..... | 16.00 |

The following statistics are compiled from data received direct from 23 producers of sand-lime brick in the United States and Canada:

***Statistics for August and September, 1927***

| | *August | †September |
|---|---|---|
| Production | 21,300,310 | 18,583,785 |
| Shipments (rail) | 7,375,600 | 6,164,375 |
| Shipments (truck) | 13,294,623 | 9,293,286 |
| Stocks | 12,547,119 | 17,552,461 |
| Unfilled orders | 19,800,000 | 13,344,000 |

*Revised to include two plants not furnishing August data previously, 25 plants reporting.

†Incomplete, six plants not reporting unfilled orders.

***Notes from Producers***

On February 1, 2 and 3, 1928, the Sand-Lime Brick Association will hold its annual convention in Washington, D. C. This will be the 24th annual meeting of the association.

Boice Bros., Pontiac, Mich., report that they are furnishing brick for the addition to the Fisher Body Corp. building and the new branch of the First National Bank of Pontiac. They are also supplying brick for the new Kenwood hotel in Pontiac.

Brick for the new Bell Telephone building in Jackson, Mich., is being furnished by the Jackson Brick Co., Jackson, Mich.

## New England Lime Producers Talk Association and Eat Lobsters

NEARLY 20 Eastern lime manufacturers gathered in Rockland, Maine, September 21, for the principal purpose of hearing the broad policies of the National Lime Association which were presented to them by G. B. Arthur, general manager of the National Lime Association from Washington, D. C.

The plan was presented in detail to a very full representation of the lime industry in New England, and a thorough discussion followed of the several features in the plan. It was accepted with enthusiasm and with a considerable increase in membership. In fact it may be said that the present position of the New England manufacturers in the lime industry is very creditable to this section of the country. This is one of a series of similar meetings being held in different parts of the country for the purpose of uniting the industry for a plan of national advertising and promotion for the general good of the lime business.

The visiting manufacturers were guests of the Rockland and Rockport Lime Corp., with President George B. Wood in the genial role of host.

Following the arrival by steamer the group was entertained at the Thorndike hotel and devoted the early forenoon to a motor tour of the local lime corporation's extensive plant. This was followed by a business meeting and then a sail of several hours via motor boat over the island-dotted bay.

Returning to Owls Head, the visitors found a very pleasant surprise awaiting in the form of an old-fashioned lobster and clam feast with William G. Walker as a most efficient chef-in-chief. The final business session held in the Rockland company's office, a visit to the new Lawrence Portland Cement Co. plant and supper at the Thorndike completed a thoroughly enjoyable party with real accomplishments in understanding and welfare of the allied industries.

The guests and their companies were: John M. Deely and John Deely, Lee Lime Corp., Lee, Mass.; A. V. A. Felton, New England Lime Co., Pittsfield, Mass.; Charles C. Bye and Samuel Shallcross, American Lime and Stone Co., Bellefonte, Penn.; Fred Barhoff and Jack Kenesny, Allyndale Lime Co., Hartford, Conn.; K. A. Nahikinen, Brewer & Co., Worcester, Mass.; H. D. Russell, F. W. Wait Lime Co., Glens Falls, N. Y.; William Flaherty, Hoosac Valley Lime Co., Adams, Mass.; F. R. Sullivan, Edward Bryant Co., Rockland, Me.; W. E. Healey, Rockland and Rockport Lime Corp.; Leo Wilson, Fonda Lime Works, St. Albans, Vt.; T. J. Curtin and Joe Curtin, Farnam-Cheshire Lime Co., Cheshire, Mass.; A. J. Bird, A. J. Bird Co., Rockland, Maine; C. A. Creighton, J. A. Creighton and Co., Thomaston, Maine; G. B. Arthur, general manager, National Lime Association, Washington; C. L. Montgomery, Vermarco Lime Co., West Rutland, Vt.; Charles Rich, Swanton Lime Works, Swanton, Vt.; G. B. Wood, H. A. Buffum, W. C. Bird, E. S. Levensaler and W. H. Rhodes, Rockland and Rocport Lime Corp.—*Rockland* (Maine) *Courier-Gazette.*

## First Shipment of Alabama Rock Asphalt Reaches New York

THE first large shipment of Alabama limestone rock asphalt ever to be sent into the state of New York was recently forwarded to the Palisade Interstate Park Commission of New York, by the Alabama Rock Asphalt, Inc., of Margerum, Ala. The shipment, which totaled 1500 tons, will be used for the construction of roads in the Palisades park near Bear Mountain, N. Y. The producers claim that for road work of this type, the Alabama asphalt will give four or five times longer wear than other asphalt, since they say their deposits are similar to the Sicilian limestone rock asphalt of Italy, which is well-known for its wearing qualities.

The product of the Alabama company's plant at Margerum has been used extensively in the south, but has not been used in the north before in any great amount. The plant has a daily capacity of 1000 tons of pulverized asphalt.—*Manufacturers Record.*

## New Plastic Lime Process Used as Argument in Texas Rate Case

THE recent hearing held before the Texas Railroad Commission (on application of the hydrated lime manufacturers of the Toledo, Ohio, district) brought forth the argument that cheaper rates would be injurious to a local industry which had recently developed a new process for making any lime plastic. This process, it was stated, had been developed over a period of 10 years and at a heavy expense by the Dittlinger Lime Co. and had been used with success on lime burned from stone produced in scattered parts of the country, according to Mr. Dittlinger. The complete text of the patent was published in ROCK PRODUCTS, September 17, 1927.

The application of the Ohio interests for a lower rate on lime from that producing region to Texas points was taken under advisement by the state railroad commission.

# Foreign Abstracts and Patent Review

**New Investigations of Gypsum Plasters.** L. Chassevent describes a calorimetric method for the analysis of plasters developed, by which the course of the heating of the plaster may be followed, and a knowledge of its ultimate properties rapidly obtained. Anhydrous calcium sulphate, dehydrated below 300 deg., is rehydrated practically instantaneously, and a measurement of the heat evolved in g.-cal. during the first 2—3 min. *(X)* is due to this cause, so that the weight in grams *(p)* of anhydrous calcium sulphate in the sample is given by the expression $p = (X - 20)/20$, the heat of dissolution of the hemihydrate being 20 g.-cal. Calcium sulphate dehydrated between 300 and 600 deg. requires seven days for complete rehydration, and the period necessary for any particular sample may be determined either (1) by measuring the electrical resistance which, when the plaster contains no calcium sulphate dehydrated above 300 deg., does not increase after several hours; or (2) by a determination of the increase in weight of a known weight of the powder kept under water and dried at 50 to 60 deg. after periods of 2, 7 and 15 days; all increase in weight between 2 to 7 days corresponds with the hydration of calcium sulphate which has been heated between 300 and 600 deg., and any increase after seven days with that heated above 600 deg., 1 g. of anhydrous calcium sulphate requiring 0.26 g. of water for hydration.

By this method the influence of the method of heating on various samples has been investigated. With samples prepared from precipitated calcium sulphate with insufficient heating a smooth temperature-time curve is obtained showing that hydration is continuous, but as the period of heating is increased a step curve results, the initial evolution of heat corresponding with the hydration of the anhydrous calcium sulphate to the hemihydrate, no further evolution of heat then occurring until crystallization of the dihydrate sets in. With a plaster prepared from gypsum at 145 deg. crystallization sets in rapidly owing to the presence of seeds of the dihydrate being present, but removal of these by heating at 200 deg. lengthens the period before crystallization sets in. A good commercial plaster shows a steep step curve. A sample of dead plaster (which had been kept for two years) does not set owing to the formation of a skin of the dihydrate over each grain, which prevents diffusion of the supersaturated solution of the hemihydrate throughout the mass, each grain setting separately. The plaster may be restored by complete dehydration at 220 deg. The lack of hardness in set plaster has been investigated, and may be due either to the presence of overburnt particles which rehydrate only slowly, or to the addition of too much water, the best proportion being 45—60 g. per 100 g. of plaster. By mixing plaster with only slightly more than the theoretical quantity of water required for hydration at 80—90 deg. and subjecting the mass to pressure (varying with the conditions and the size of the particles employed), samples having an apparent density greater than 2, a high resistance to compression and an appearance like marble have been obtained. An attempt thus to prepare artificial alabaster was unsuccessful, the samples always being opaque and having a density less than 2.3. If plaster is hydrated with boiling water, care being taken that the temperature of the mass never falls below 63 deg., and the liquid mass is stored in steam-jacketed vessels, it remains plastic for many hours, but on allowing the temperature to fall to 40 deg. it sets in the usual manner. By this means a smaller quantity of water is required for hydration, the plaster may be stored during use and machinery employed to mix and work it.—*Chim. Ann.* (1927) **7**, 43-68 and *Jour. Soc. Chem. Ind. (England)* (1927), **38**, 722.

**Magnesite Cement.** Anhydrous ferrous chloride is ground and mixed with magnesium oxide and fillers to form a magnesite cement which can be stored or carried without deterioration and does not require skilled labor to apply. *English Patent No.* 268,989.

## Recent Process Patents

*The following brief abstracts are of current process patents issued by the U. S. Patent Office, Washington, D. C. Complete copies may be obtained by sending 10c to the Superintendent of Documents, Government Printing Office, Washington, for each patent desired.*

**Gypsum Wallboard.** A rigid, waterproof, nail penetrable wallboard comprising a plastic mix of deflocculated clay, a bituminous material, and calcined gypsum in suitable proportions. *M. K. Armstrong, U. S. No.* 1,641,611.

**Manufacture of Precipitated Calcium Carbonate.** An amorphous calcium carbonate is made by passing an aqueous suspension of calcium hydroxide into intimate contact with carbon dioxide gas at temperature of about 95 deg. F. The precipitated carbonate is removed from the accompanying water by mechanical means. *B. G. Wood, U. S. No.* 1,641,563.

**Wear-resisting, Non-dusting Cement Surface.** A composition adapted, when admixed with sand or like aggregate and water, to form a water- and wear-resisting, non-dusting, concrete surfacing for floors, walks and the like, comprising an intimate admixture in dry powdered form of portland cement and from 5% to 10% by weight of an iron-free abrasive of substantially the hardness and specific gravity of carborundum and of about 100-mesh fineness. *U. S. Patent No.* 1,633,790.

**Rotary Kiln Manufacture of Aluminous Cements.** The production of low lime aluminous cements by the wet process comprising a mixture of equal parts of bauxite and lime which when calcined will produce a cement containing 6% silica, 41% alumina, 11% iron oxide, 41% lime and 1% of undetermined material. Calcining is carried out at temperatures sufficient to fuse the raw materials and in a rotary cement kiln whose length is not greater than 10 times its internal diameter. Shorter kilns may be used with waste heat equipment. *Henry S. Spackman, U. S. Patent No.* 1,643,136.

**Improved Plaster Board.** The covering sheets of the board are folded over the junctions of the side edges and faces and again folded and embedded in the plaster composition in spaced relation so as to expose a portion along the side edges of the board. *S. C. Clark, U. S. Patent No.* 1,642,840.

**Covered Edge Wallboard.** The process of finishing plaster board initially manufactured with a covered edge formed during the process of manufacture by folding the margins of the covering sheets over the edge of the plaster body and thence into said body between said cover sheets, consisting of advancing the boards lengthwise between rotative grinding wheels acting simultaneously on opposite side edges to remove the covering at the edge and leaving the embedded portions as reinforcing strips. *S. C. Clarke, U. S. Patent No.* 1,639,128.

**Concrete Plaque.** The process of reproducing a given design in a colored cement tile or plaque, which comprises the following steps: placing a glass plate over said design, arranging moist masses of differently colored hydraulic cement on said glass plate over the respective portions of the design to be reproduced in the colors of the mass so placed thereover, immersing said cement and glass plate in water until the cement is set and then removing the plaque so formed from said glass plate whereby the said design is reproduced in corresponding colors upon the extremely smooth glazed plane surface of the resultant plaque. —*I. M. Washington, U. S. Patent No.* 1,641,404.

[A patent on the plaque itself was denied because similar plaques have been made of clay tile before (details in a later issue)].

# Traffic and Transportation

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## Car Loadings of Sand and Gravel, Stone and Limestone Flux

THE following are the weekly car loadings of sand and gravel, crushed stone and limestone flux (by railroad districts), as reported by the Car Service Division, American Railway Association, Washington, D. C.:

CAR LOADINGS OF SAND, GRAVEL, STONE AND LIMESTONE FLUX

| District | Limestone Flux Week ended Sept. 10 | Limestone Flux Week ended Sept. 17 | Sand, Stone and Gravel Week ended Sept. 10 | Sand, Stone and Gravel Week ended Sept. 17 |
|---|---|---|---|---|
| Eastern | 4,017 | 4,279 | 15,429 | 18,759 |
| Allegheny | 3,279 | 4,047 | 11,321 | 13,354 |
| Pocahontas | 732 | 594 | 1,308 | 1,601 |
| Southern | 663 | 777 | 12,876 | 14,091 |
| Northwestern | 1,491 | 1,852 | 9,870 | 10,495 |
| Central western | 536 | 535 | 10,763 | 12,263 |
| Southwestern | 454 | 543 | 7,137 | 7,224 |
| Total | 11,172 | 12,627 | 68,704 | 77,787 |

COMPARATIVE TOTAL LOADINGS, BY DISTRICTS, 1926 AND 1927

| District | Limestone Flux 1926 Period to Date Sept. 18 | Limestone Flux 1927 Period to Date Sept. 17 | Stone, Gravel and Stone 1926 Period to Date Sept. 18 | Stone, Gravel and Stone 1927 Period to Date Sept. 17 |
|---|---|---|---|---|
| Eastern | 125,806 | 127,967 | 363,579 | 367,943 |
| Allegheny | 143,403 | 133,492 | 271,097 | 276,015 |
| Pocahonas | 19,230 | 19,226 | 32,195 | 33,441 |
| Southern | 24,928 | 21,727 | 452,792 | 452,018 |
| Northwestern | 53,030 | 51,530 | 234,007 | 238,686 |
| Central western | 18,721 | 18,913 | 335,096 | 339,275 |
| Southwestern | 10,919 | 12,661 | 192,679 | 198,652 |
| Total | 396,037 | 385,516 | 1,881,445 | 1,906,030 |

COMPARATIVE TOTAL LOADINGS 1926 AND 1927

| | 1926 | 1927 |
|---|---|---|
| ***Limestone flux*** | ***396,037*** | ***385,516*** |
| ***Sand, stone, gravel*** | ***1,881,445*** | ***1,906,030*** |

## Proposed Changes in Rates

THE following are the latest proposed changes in freight rates up to the week beginning October 8:

### ILLINOIS FREIGHT ASSOCIATION DOCKET

4003-B. Rip rap or **broken stone**, carloads, minimum weight marked capacity of car, from Shelterville, Ill., to Levings, Ill., via Parker and C. C. C. & St. L. Ry. Present, none; proposed, 90c per ton of 2000 lb.

4003 (Sub. 1). **Crushed stone**, carloads, minimum weight marked capacity of car, from Anna, Ill., to C. C. C. St. L. Ky. stations, Vienna to America, Inc. Rates in cents per net ton. Present, no through rate; proposed, 101.

4150-B. **Crushed stone, sand and gravel**, carloads, minimum weight 90% of marked capacity of car used, from Forreston and Joliet, Ill., to B. & O. R. R. stations, viz.: Casner and La Place, Ill. Present, based on full combination of locals or through class rates; proposed, $1.26 per net ton.

4201. **Sand and gravel**, carloads, minimum weight marked capacity of car, from Chillicothe, Ill., to T. P. & W. R. R. stations (rates per net ton):

| To— | Present. | Proposed. |
|---|---|---|
| Crescent City, Ill. | 115 | 101 |
| Watseka, Ill. | 115 | 101 |
| Leonard, Ill. | 115 | 101 |

2585, Sub. 1. **Silica sand**, carloads, from Oregon, Ottawa, Wedron and Millington, Ill., to Murphysboro, Ill. Present, $2.90 per net ton; proposed, $2.39 per net ton.

3670, Sub. 1. **Sand and gravel**, carloads, minimum weight 90% of marked capacity of car, but not less than 40,000 lb., from Chillicothe, Ill., to Winchester, Ill. Present—163c per ton of 2000 lb. Proposed, 151c per ton of 2000 lb.

4206. **Sand, gravel, crushed stone** and cinders, carloads, minimum weight 90% of marked capacity of car, between Carbon Cliff, Bettendorf, Davenport, East Moline, Linwood, Moline, Rock Island and Silvis. Present, 47½c per ton of 2000 lb. (no switching to be absorbed). Proposed, 47½c per ton of 2000 lb. (to eliminate clause, "No switching to be absorbed").

### CENTRAL FREIGHT ASSOCIATION DOCKET

16688. To establish on **crushed stone**, in bulk, in open top cars, carloads, Woodville, Ohio, rate of 115c per net ton to Armstrong and Wadsworth, Ohio, and 135c per net ton to East Sparta, Ohio. Present rates, 320c to Armstrong, 340c to East Sparta and 125c per net ton to Wadsworth, Ohio.

16645. To establish on (a) **sand and gravel**, carloads, from Kern, Terre Haute and Brevoorts, Ind.; (b) **crushed stone**, carloads, from Greencastle, Ind., rates to points on the Cairo division of the C. C. C. & St. L. Ry., Marshall, Ill., and south, as shown under the column headed "Proposed" in Exhibit "A" attached hereto. Present rates as shown in Exhibit "A" attached.

16690. To establish on **sand and gravel**, carloads, Vincennes, Ind., to Fritchton, Ind., rate of 60c per net ton. Present rate, 54c per net ton.

16693. To establish on **crushed stone**, carloads, East Liberty, Ohio, to Westerville, Ohio, rate of 85c per net ton. Present rate, 90c per net ton.

16694. To establish on **sand and gravel** (all kinds), carloads, from Somerdale, New Cumberland and Sherrodsville, Ohio, to Hubbard, Ohio, rate of 90c per net ton. Present rate, 100c per net ton.

16697. To establish on **crushed stone**, carloads, from Marble Cliff, Ohio, to Carbondale, Ohio, rate of 130c per net ton. Present rate, 320c per net ton.

16700. To publish the following restrictions in C. F. A. T. B. Tariff 420A, naming rates on **crushed stone, gravel and sand**, from points in Indiana to Chicago, Ill., etc. (a) To amend pages 6, 7 and 9 to provide that the rates on **crushed stone, gravel and sand** from Elkhart, Ginger Hill and Rupel, Ind., to Chicago, Ill. (single line and joint haul), will only apply via the New York Central railroad through South Bend and will not apply via the Illinois division. (b) To provide in the aforesaid tariff that the rates on **crushed stone, gravel and sand** from Lehigh, Ill., and Morocco, Ind., to Chicago, Ill., will not apply via the South Bend division of the New York Central railroad but will apply via the Illinois division.

EXHIBIT "A"
Rates in Cents per Net Ton

| To | Kern, Ind. Sand and Gravel Current | Prop. |
|---|---|---|
| Paris, Ill. | 70 | .... |
| Oliver, Ill. | 80 | .... |
| Marshall, Ill. | 80 | .... |
| Arnolds Switch | 81 | .... |
| Snyder, Ill. | 81 | .... |
| Walnut Prairie, Ill. | 81 | .... |

EXHIBIT "A"
Rates in Cents per Net Ton

| To | Kern, Ind. Sand and Gravel Current | Prop. |
|---|---|---|
| West Union, Ill. | 81 | .... |
| Rock Hill Switch, Ill. | 81 | .... |
| West York, Ill. | 81 | 86 |
| Coal Dock Switch, Ill. | 81 | 86 |
| Hutsonville, Ill. | 81 | 86 |
| Trimble, Ill. | 81 | 86 |
| Robinson, Ill. | 81 | 86 |
| Duncanville, Ill. | 88 | 95 |
| Flat Rock, Ill. | 88 | 95 |
| Birds, Ill. | 88 | 95 |
| Pinkstaff, Ill. | 88 | 95 |
| Lawrenceville, Ill. | 101 | 95 |
| Billett, Ill. | 101 | 95 |
| St. Francisville, Ill. | 101 | 95 |
| Allendale, Ill. | 101 | 95 |
| Patton, Ill. | 101 | 95 |
| Mt. Carmel, Ill. | 101 | 95 |
| Schrodts, Ill. | 113 | 101 |
| Keensburg, Ill. | 113 | 101 |
| Cowling, Ill. | 113 | 101 |
| Grayville, Ill. | 113 | 101 |
| Calvin, Ill. | 113 | 101 |
| Crossville, Ill. | 113 | 101 |
| Simpson, Ill. | 113 | 101 |
| Carmi, Ill. | 113 | 101 |
| Brownsville, Ill. | 113 | 101 |
| Norris City, Ill. | 113 | 101 |
| Gossett, Ill. | 113 | 113 |
| Texas City, Ill. | 113 | 113 |
| Eldorado, Ill. | 113 | 113 |
| Muddy, Ill. | 113 | 113 |
| Harrisburg, Ill. | 113 | 113 |
| Ledford, Ill. | 126 | 126 |
| Carrier Mills, Ill. | 126 | 126 |
| Stonefort, Ill. | 126 | 126 |
| New Burnside, Ill. | 126 | 126 |
| Parker, Ill. | 126 | 126 |
| Tunnell Hill, Ill. | 126 | 126 |
| Bloomfield, Ill. | 126 | 126 |
| Vienna, Ill. | 126 | 126 |
| Forman, Ill. | 126 | 126 |
| Belknap, Ill. | 126 | 126 |
| Karnak, Ill. | 126 | 126 |
| Crand Chain, Ill. | 126 | 126 |
| Levings, Ill. | 126 | 126 |
| Olmstead, Ill. | 126 | 126 |
| America, Ill. | 126 | 126 |
| Mound City, Ill. | 126 | 126 |
| Cairo, Ill. | 126 | 126 |

| To | Terre Haute, Ind. Sand and Gravel Current | Prop. |
|---|---|---|
| Paris, Ill. | 63 | .... |
| Oliver, Ill. | 66 | .... |
| Marshall, Ill. | 66 | .... |
| Arnolds Switch, Ill. | 76 | .... |
| Snyder, Ill. | 76 | .... |
| Walnut Prairie, Ill. | 76 | .... |
| West Union, Ill. | 76 | .... |
| Rock Hill Switch, Ill. | 76 | .... |
| West York, Ill. | 76 | .... |
| Coal Dock Switch, Ill. | 76 | 80 |
| Hutsonville, Ill. | 76 | 80 |
| Trimble, Ill. | 76 | 80 |
| Robinson, Ill. | 76 | 80 |
| Duncanville, Ill. | 88 | .... |
| Flat Rock, Ill. | 88 | .... |
| Birds, Ill. | 88 | .... |
| Pinkstaff, Ill. | 88 | .... |
| Lawrenceville, Ill. | 88 | .... |
| Billett, Ill. | 88 | .... |
| St. Francisville, Ill. | 88 | .... |
| Allendale, Ill. | 88 | .... |
| Patton, Ill. | 88 | .... |
| Mt. Carmel, Ill. | 88 | .... |
| Schrodts, Ill. | 101 | .... |
| Keensburg, Ill. | 101 | .... |
| Cowling, Ill. | 101 | .... |
| Grayville, Ill. | 101 | .... |
| Calvin, Ill. | 101 | .... |
| Crossville, Ill. | 101 | .... |
| Simpson, Ill. | 101 | .... |
| Carmi, Ill. | 101 | .... |
| Brownsville, Ill. | 101 | .... |
| Norris City, Ill. | 101 | .... |
| Gossett, Ill. | 101 | 113 |
| Texas City, Ill. | 101 | 113 |
| Eldorado, Ill. | 101 | 113 |
| Muddy, Ill. | 101 | 113 |
| Harrisburg, Ill. | 101 | 113 |
| Ledford, Ill. | 113 | 126 |
| Carrier Mills, Ill. | 113 | 126 |
| Stonefort, Ill. | 113 | 126 |
| New Burnside, Ill. | 113 | 126 |

### CENTRAL FREIGHT ASSOCIATION DOCKET (Continued)

| | | |
|---|---|---|
| Parker, Ill. | 113 | 126 |
| Tunnell Hill, Ill. | 126 | ---- |
| Bloomfield, Ill. | 126 | ---- |
| Vienna, Ill. | 126 | ---- |
| Forman, Ill. | 126 | ---- |
| Belknap, Ill. | 126 | ---- |
| Karnak, Ill. | 126 | ---- |
| Grand Chain, Ill. | 126 | ---- |
| Levings, Ill. | 126 | ---- |
| Olmstead, Ill. | 126 | ---- |
| America, Ill. | 126 | ---- |
| Mound City, Ill. | 126 | ---- |
| Cairo, Ill. | 126 | ---- |

| To | Greencastle, Ind. Crushed Stone Current | Prop. |
|---|---|---|
| Paris, Ill. | 70 | ---- |
| Oliver, Ill. | 76 | ---- |
| Marshall, Ill. | 76 | ---- |
| Arnolds Switch, Ill. | 81 | ---- |
| Snyder, Ill. | 88 | 81 |
| Walnut Prairie, Ill. | 88 | 81 |
| West Union, Ill. | 88 | 81 |
| Rock Hill Switch, Ill. | 88 | 81 |
| West York, Ill. | 88 | 86 |
| Coal Dock Switch, Ill. | 88 | 86 |
| Hutsonville, Ill. | 88 | 86 |
| Trimble, Ill. | 88 | 86 |
| Robinson, Ill. | 88 | 86 |
| Duncanville, Ill. | 88 | 95 |
| Flat Rock, Ill. | 88 | 95 |
| Birds, Ill. | 88 | 95 |
| Pinkstaff, Ill. | 88 | 95 |
| Lawrenceville, Ill. | 88 | 95 |
| Billett, Ill. | 88 | 95 |
| St. Francisville, Ill. | 88 | 95 |
| Allendale, Ill. | 88 | 95 |
| Patton, Ill. | 88 | 95 |
| Mt. Carmel, Ill. | 88 | 95 |
| Schrodts, Ill. | 101 | ---- |
| Keensburg, Ill. | 101 | ---- |
| Cowling, Ill. | 101 | ---- |
| Grayville, Ill. | 101 | ---- |
| Calvin, Ill. | 101 | ---- |
| Crossville, Ill. | 101 | ---- |
| Simpson, Ill. | 101 | ---- |
| Carmi, Ill. | 101 | ---- |
| Brownsville, Ill. | 101 | ---- |
| Norris City, Ill. | 101 | ---- |
| Gossett, Ill. | 101 | 113 |
| Texas City, Ill. | 101 | 113 |
| Eldorado, Ill. | 101 | 113 |
| Muddy, Ill. | 101 | 113 |
| Harrisburg, Ill. | 101 | 113 |
| Ledford, Ill. | 126 | 126 |
| Carrier Mills, Ill. | 126 | 126 |
| Stonefort, Ill. | 126 | 126 |
| New Burnside, Ill. | 126 | 126 |
| Parker, Ill. | 126 | 126 |
| Tunnell Hill, Ill. | 126 | 126 |
| Bloomfield, Ill. | 126 | 126 |
| Vienna, Ill. | 126 | 126 |
| Forman, Ill. | 126 | 126 |
| Belknap, Ill. | 126 | 126 |
| Karnak, Ill. | 126 | 126 |
| Grand Chain, Ill. | 126 | 126 |
| Levings, Ill. | 126 | 126 |
| Olmstead, Ill. | 126 | 126 |
| America, Ill. | 126 | 126 |
| Mound City, Ill. | 126 | 126 |
| Cairo, Ill. | 126 | 126 |

| To | Brevoorts, Ind. Sand and Gravel Proposed |
|---|---|
| Paris, Ill. | ---- |
| Oliver, Ill. | ---- |
| Marshall, Ill. | 81 |
| Arnolds Switch, Ill. | 81 |
| Snyder, Ill. | 81 |
| Walnut Prairie, Ill. | 81 |
| West Union, Ill. | 81 |
| Rock Hill Switch, Ill. | 81 |
| West York, Ill. | 81 |
| Coal Dock Switch, Ill. | 80 |
| Hutsonville, Ill. | 80 |
| Trimble, Ill. | 80 |
| Robinson, Ill. | 76 |
| Duncanville, Ill. | 76 |
| Flat Rock, Ill. | 76 |
| Birds, Ill. | 76 |
| Pinkstaff, Ill. | 76 |
| Lawrenceville, Ill. | 70 |
| Billett, Ill. | 70 |
| St. Francisville, Ill. | 63 |
| Allendale, Ill. | 70 |
| Patton, Ill. | 70 |
| Mt. Carmel, Ill. | 70 |
| Schrodts, Ill. | 76 |
| Keensburg, Ill. | 76 |
| Cowling, Ill. | 76 |
| Grayville, Ill. | 76 |
| Calvin, Ill. | 88 |
| Crossville, Ill. | 88 |
| Simpson, Ill. | 88 |
| Carmi, Ill. | 88 |
| Brownsville, Ill. | 88 |
| Norris City, Ill. | 88 |
| Gossett, Ill. | 88 |
| Texas City, Ill. | 88 |
| Eldorado, Ill. | 88 |

### CENTRAL FREIGHT ASSOCIATION DOCKET (Continued)

| | |
|---|---|
| Muddy, Ill. | 88 |
| Harrisburg, Ill. | 88 |
| Ledford, Ill. | 88 |
| Carrier Mills, Ill. | 101 |
| Stonefort, Ill. | 101 |
| New Burnside, Ill. | 101 |
| Parker, Ill. | 101 |
| Tunnell Hill, Ill. | 101 |
| Bloomfield, Ill. | 101 |
| Vienna, Ill. | 101 |
| Forman, Ill. | 101 |
| Belknap, Ill. | 101 |
| Karnak, Ill. | 101 |
| Grand Chain, Ill. | 113 |
| Levings, Ill. | 113 |
| Olmstead, Ill. | 113 |
| America, Ill. | 113 |
| Mound City, Ill. | 113 |
| Cairo, Ill. | 113 |

16719. To establish on **limestone, ground or pulverized,** carloads, Piqua, Ohio, to Gadsden, Ohio, and Lebanon, Ind., rate of 202c per net ton. Present rate, 340c per net ton, sixth class.

16625. To establish on **crushed stone,** in bulk, in open top cars, carloads, Marble Cliff, Ohio, to Powhatan, Ohio, 150c per net ton. Present rate, 410c per net ton.

16626. To establish on **sand,** carloads, Chalfant, Ohio, also Zanesville, Group to Harvard, Ill., 353c per net ton. Present rate, 27c.

16636. To establish on **sand and gravel,** carloads, Phalanx, Ohio, to Charlestown and Wayland, Ohio, 70c per net ton. Present rate, 80c per net ton.

### SOUTHERN FREIGHT ASSOCIATION DOCKET

36226. **Crushed stone, marble, slate, limestone,** from L. & N. R. R. shipping points to Davenport, Iowa. Combination now applies. It is proposed to establish the following through commodity rates to Davenport, Iowa:

| From— | Description | In cents per net ton |
|---|---|---|
| Tate, Ga. | A | 529 |
| Whitestone, Ga. | C | 529 |
| Mineral Bluff, Ga. | E | 520 |
| Kinsey, N. C. | E | 529 |
| Bolivar, Ga. | H | 529 |
| Fairmount, Ga. | H | 529 |
| Marmor, Tenn. | I | 493 |
| Tellico Plains, Tenn. | H | 511 |
| Knoxville, Tenn. | J | 493 |
| Brownson, Ala. | K | 529 |
| Gantt's Quarry, Ala. | K | 529 |

A—Marble, crushed, in bags, carloads, minimum weight as per Note 1.

C—Stone, crushed, carloads, minimum weight as per Note 1.

E—Marble or limestone, crushed, in barrels, bags or in bulk, carloads, minimum weight as per Note 1.

H—Stone or slate, crushed, carloads, minimum weight as per Note 1.

I—Stone, marble or slate, broken or crushed, carloads, minimum weight as per Note 1.

J—Stone, marble or slate, broken or crushed, and marble spalls, carloads, minimum weight as per Note 1.

K—Marble, crushed, carloads, minimum weight as per Note 1.

Note 1—Minimum weight 90% of marked capacity of car, except where cars are loaded to their full visible capacity, actual weight shall govern.

The suggested rate from Whitestone, Ga., is the same as rate in effect to Rock Island, Ill. From other origins shown, the proposed rates are made with relation to the rates suggested on crushed stone from Whitestone, Ga.

36302. **Crushed stone,** from Klotz and Longcor, Va., to Beaufort, N. C. It is proposed to establish rate of 215c per net ton on stone, crushed, carloads, minimum weight 100,000 lb. (except as in Note A), from Klotz and Longcor, Va., to Beaufort, N. C.—Same as suggested under Submittal 35922 from Rocky Point, Indian Rock and Eagle Mountain, Va., to Beaufort.

36396. **Gravel,** from Golden, Miss., to Saulsbury, Tenn. Present rate, 140c per net ton. (Combination.) Proposed rates from Golden, Miss., to Saulsbury, Tenn.: Gravel, washed or screened (See Note A), carloads, 113c per net ton. Gravel, not washed or screened, carloads, minimum weight same as specified in connection with the washed or screened rate, 79c per net ton. Proposed rates are the same as in effect to Memphis, Tenn.

36409. **Crushed marble,** from Louisville and Pinkmar, Tenn., to Ohio River crossings and St. Louis, Mo., group. Class A rates now apply, and it is proposed to establish rates on marble, crushed, carloads (See Note A), from Louisville and Pinkmar, Tenn., to Cincinnati, Ohio, Covington and Newport, Ky., St. Louis, Mo., East St. Louis and Belleville, Ill., the same as rates currently in effect from Marmor, Tenn.

### SOUTHWESTERN FREIGHT BUREAU DOCKET

13335. **Crushed stone,** from Whitestone, Ga., to Corpus Christi, Texas. To establish a rate of $7.25 per ton of 2000 lb. on:

To Vicksburg—**Stone, crushed,** carloads, minimum weight 90% of marked capacity of car except when cars are loaded to their visible capacity, actual weight shall govern.

To Shreveport—**Stone, crushed,** carloads, minimum weight marked capacity of car, but not less than 60,000 lb.

Beyond Shreveport—**Stone, crushed,** carloads, minimum weight 50,000 lb., or marked capacity of car if that be less than 50,000 lb., from Whitestone, Ga., to Corpus Christi, Texas.

It is proposed to publish a through rate of $7.25 per ton of 2000 lb. on crushed stone, carloads, from Whitestone, Ga., to Corpus Christi, Texas, which reflects Vicksburg, Miss.-Shreveport, La., combination, with routing restrictions, and thus place the New Orleans gateways on a parity with Vicksburg.

13338. **Agricultural limestone,** from Carthage, Mo., to points in Oklahoma. To establish the following distance scale of rates on agricultural limestone, carloads (See Note A), but in no case shall the minimum weight be less than 40,000 lb., from Carthage, Mo., to points in Oklahoma located beyond the Mo. Pac. R. R.:

| Distance— | | Rates— Via two lines | Via three lines |
|---|---|---|---|
| 50 miles and over | 40 | 80 | 90 |
| 60 miles and over | 50 | 85 | 90 |
| 70 miles and over | 60 | 90 | 100 |
| 80 miles and over | 70 | 95 | 100 |
| 90 miles and over | 80 | 105 | 105 |
| 100 miles and over | 90 | 110 | 110 |
| 110 miles and over | 100 | 115 | 115 |
| 120 miles and over | 110 | 120 | 120 |
| 125 miles and over | 120 | 130 | 130 |
| 130 miles and over | 125 | 130 | 130 |
| 140 miles and over | 130 | 130 | 130 |
| 150 miles and over | 140 | 135 | 135 |
| 160 miles and over | 150 | 135 | 135 |
| 170 miles and over | 160 | 140 | 140 |
| 175 miles and over | 170 | 145 | 145 |
| 180 miles and over | 175 | 145 | 145 |
| 190 miles and over | 180 | 150 | 150 |
| 200 miles and over | 190 | 155 | 155 |
| 210 miles and over | 200 | 160 | 160 |
| 220 miles and over | 210 | 160 | 160 |
| 230 miles and over | 220 | 170 | 170 |
| 240 miles and over | 230 | 170 | 170 |
| 250 miles and over | 240 | 175 | 175 |

The proposed scale is now in effect on limestone originating Carthage, Mo., when destined southeast stations. It is a joint line scale and the proponent feels that he is entitled to the same scale from Carthage when destined Oklahoma stations on this same commodity.

### TRUNK LINE ASSOCIATION DOCKET

16432. (A) **Sand, blast, engine, glass, molding, foundry, silica, silex** or quartz, carloads. (B) **Sand,** other than blast, engine, glass, foundry, molding, silica, silex or quartz, **and gravel,** carloads.

To Durant City, Penn.—Proposed rates:

| From— | (A) | (B) |
|---|---|---|
| Falls Creek, Penn. | 110 | 110 |
| Ridgway, Penn. | 110 | ---- |
| Hutchins, Penn. | 110 | ---- |

Rates in cents per 2000 lb. Reason—Proposed rates compare favorably with rates on like commodities from and to points in the same general territory as per B. R. & P. I. C. C. 8044.

16436. **Sand and gravel,** carloads, from Farmingdale to Whitings, N. J., inclusive, to Bennington, Vt., 18½c per 100 lb. Reason—Proposed rate is comparable with rates on like commodities from and to points in the same general territory as per C. N. J. I. C. C. G2363.

16438. **Crushed stone;** crushed stone coated with oil, tar or asphaltum; **gravel and sand;** and slag, granulated, lump or pulverized, carloads, minimum weight 90% of marked capacity of car, from Fast Buffalo, Buffalo, Buffalo Lake and Black Rock, N. Y., to Olcott, N. Y., $1.15 per ton of 2000 lb. Reason—Proposed rate is comparable with rates now in effect from Arcade, N. Y., as per Erie I. C. C. 17953.

16476. (B) **Agricultural,** land, chemical, gas or glass **lime,** carloads, minimum weight 30,000 lb., and **ground limestone,** carloads, minimum weight 50,000 lb., from Jersey Shore, Penn., To Tunkhannock, Meshoppen, Wyalusing and Wysox, Penn., 16½c per 100 lb. Reason—Proposed rates are comparable with rates now in force from Bellefonte, Penn., to same points of destination per P. R. R. C. O.-I. C. C. 14567.

16479. **Sand, blast, engine, foundry, molding, ground, flint, quartz, silex or brick sand,** carloads, minimum weight 90% of marked capacity of car, from Mapleton District, Penn., to Bridgeburg and Reesedale, Penn., $216 per ton of 2000 lb. Reason—Proposed rate is comparable with rate to Kittanning, St. Marys, Templeton, Penn., etc., as per P. R. R. G. O. I. C. C. 14553.

# Hearings on Gravel Rates in Southwest Are Postponed

## Every Producer in the United States Has an Interest in the Outcome

THE Interstate Commerce Commission on September 28 announced a postponement of the hearing in connection with its investigation of rates on sand, gravel, cushed stone and shells within the southwest, Part II of its rate structure investigation, No. 17000, and related cases, to November 5 at the St. Charles hotel, New Orleans, La.

Immediately after the close of the hearing at New Orleans hearings will be held at the Hotel Adolphus, Dallas, Texas. The hearing was originally assigned for October 31 at Dallas and at New Orleans immediately thereafter. The hearing will be before Examiner Waters.

Frank Leffenwell, traffic attorney, Dallas, Tex., will appear as counsel for the crushed stone, sand and gravel producers in the territory affected. Mr. Leffenwell has at various times represented producers of both commodities and is familiar with their transportation characterstics.

### *A Matter of Concern to Whole Industry*

The seriousness of the issue to come before the New Orleans hearing in November and the Dallas hearing later can be appreciated from the following remarks of J. A. Coffey, general traffic manager of the Missouri Portland Cement Co., St. Louis, Mo., reported by Jean H. Knox, consulting engineer, Dallas, Tex., who represented Rock Products at the Dallas meeting of the producers (see Rock Products, October 1, pp. 105, 106):

"The speaker has been connected with the sand, gravel and cement industry for the past ten years, and in the various capacities relating to the transportation department, has been placed more or less in contact with railroad executives and transportation experts of practically all the important industries and railroads in the United States. On account of numerous appearances before the state commissions and the Interstate Commerce Commission, it of course has been my duty and, in a great many instances, my pleasure, to absorb quite a bit of knowledge and information which enables me to speak somewhat freely on the Hoch-Smith resolution.

"I, personally, have been very fearful of the Hoch-Smith resolution, in that it has a very drastic purpose to regulate the rates or charges of transportation on agricultural products, including live-stock, to the end that these commodities will pay the lowest possible freight rate and move freely. I, personally, have never felt that any such drastic regulation by congress would, in any way, help the producers of agricultural products or the railroads themselves. I recently asked a very prominent railroad traffic expert and one who perhaps is closer to the pulse of general transportation conditions than any man in the United States, what would be the outcome of the various investigations made under the guise or direction, if you so term it, of the Hoch-Smith resolution. His answer was to the effect that if the commission ordered a general readjustment, which of course would probably be a reduction in the rates of agricultural products, it was obvious that certain commodities which have been moving in great volume within the past five or six years, would naturally have to stand an advance in freight rates to offset any reduction given to the farm products. I might state that the remarks of this gentleman coincide entirely with my views.

### *May Be Starting General Investigation Piece-Meal*

"It is a certainty that if the commission has the power, and I do not doubt but what it has, under the Hoch-Smith resolution, to investigate the rates on agricultural products, it certainly has the power to order a general investigation, although it may start in a piece-meal manner on the sand, gravel and crushed stone rates as well as cement rates of commodities of this nature, which have increased in volume in the past ten years. It appears to me that this is the purpose of the hearing to be held in New Orleans, La., and Dallas, Tex., in November. Although this hearing relates primarily to the rates in Arkansas, Louisiana and Texas, there is nothing to prevent such an investigation being continued throughout the United States.

"When one stops to consider that sand, gravel and crushed stone have paid a greater car-mile revenue than any other commodity transported in the United States during the past several years, it is certainly time for the sand, gravel and crushed stone industry to get together; and if an investigation is to be made, the industry should be in a position to demand and secure lower rates in per ton and in per car than are in effect today. It stands to reason that the loss and damage on these commodities are practically nil; that the transportation charges on these commodities form a greater percentage of the delivered cost than in the case of any other commodity; that the average price of these materials at the plant is equaled by the average freight rate after the shipments have traversed a distance of approximately twelve miles; that these commodities are transported in such a manner by the use of certain equipment, which make the traffic more attractive or favorable than any other commodity.

### *Have Very Favorable Transportation Characteristics*

"The speaker has always felt that the gross and net revenue of the carriers should be measured as a general proposition in car-mile earnings and not in any unit such as cents per hundred pounds or cents per ton; and when one stops to consider that in a great many instances these commodities (sand, gravel and crushed stone), on account of the mileage rates in effect throughout the United States, move in such a manner that the turn-over or release of the car is usually very prompt, it cuts down the detention costs and permits the carriers to utilize the same equipment for these and other commodities almost immediately.

"In our part of the country the entire movement of gravel from a plant located 25 miles west of St. Louis in the general direction of the coal mines. In other words, the coal cars moving from points of consumption are handled directly past our plant into the St. Louis-East St. Louis switching district, and for the Illinois fields. So, as far as we are concerned, we are contributing a commodity which moves from a favorable geographical location, which permits the carriers to receive at least a portion of a return haul with a commodity loaded in its open-top equipment. I think this is true in a great many instances, especially in Central Freight Association territory.

"The Hoch-Smith resolution, to my way of thinking, is a menace to the entire rate structure of the United States. It certainly is a menace to the carriers, and with the investigation ordered by the commission relating to the Southwestern sand, gravel and stone rates, it may prove a very serious and destructive menace to the consumer as well as the shippers and producers of sand, gravel and crushed stone.

"If there had been any doubt in the speaker's mind in the past as to the outcome of such a piece of legislation, I respectfully direct you to the commission's decision in a case known as the Deciduous Fruit Rates, I. C. C.-19130, California Growers and Shippers' Protective League versus the Southern

Pacific Railroad et al., Opinion 12380, reported 129 I. C. C. 25-62. This decision, which of course speaks for itself clearly, as stated by Commissioner McManamy in his dissent, gives you an idea as to the power of the commission under the Hoch-Smith resolution. The commission, as I feel, has always had the power to investigate the entire rate structure of the United States, and give each and every commodity its just and reasonable rates for transportation, the restriction being, of course, that the rates must be unprejudicial of certain interests and entirely unpreferential in every case. This is embodied in the Interstate Commerce act, which has been in effect since 1887. However, the Hoch-Smith resolution desires that investigations be made with the purpose of affording relief to the agricultural interests, and it is a certainty that if we expect an efficient railroad system in this country, which we have had for the past four years, it cannot be accomplished unless some commodities such as ours are unduly burdened with additional transportation charges.

***What Are the Basic Commodities?***

"The question of basic commodities has always been a troublesome one to me, but it is certainly apparent that certain of our learned statesmen feel that the products of the soil and live stock are *the* basic commodities of this country. However, it appears to me that such commodities as coal, lumber, sand, gravel, crushed stone, cement and products of the steel mills are just as much basic commodities, if not more so, in a great many communities, than are the commodities recognized as basic by our learned statesmen. There is no doubt, and statistics prove, that the road building projects in the United States subsequent to the World War, have certainly increased the carriers' revenue substantially, and have added to the prosperity of the country as a whole. This in turn enabled the carriers to make greater expenditures for equipment; to make enormous expenditures for improved facilities as well as expend certain sums of money for maintenance, which in turn enables other industries supplying such commodities to further prosper, which in turn is passed on to the country at large."

***Preliminary Meeting Called for Little Rock***

Sand and gravel producers in the southwest, according to the *Oklahoma City* (Okla.) *Times* of September 28, have been called to a preliminary meeting in Little Rock, Ark., October 25, to consider matters prior to the I. C. C. hearing at New Orleans.

I. G. Bentley, traffic manager of the Chamber of Commerce, Little Rock, has received a letter from Wylie M. Barrow, Batron Rouge, La., representing Louisiana shippers, advising him of the meeting.

With present rates affecting shipments of sand and gravel for state road building, the New Orleans hearing before the Interstate Commerce Commission will bear on a complaint filed with the Oklahoma state corporation commission by Edwin Dabney, state attorney general, for a hearing on intrastate shipment. The complaint was joined with the investigation instituted by the Interstate Commerce Commission.

## Proposed New Rates for Sand and Gravel in South

THE Interstate Commerce Commission made public recently a report proposed by Examiner E. H. Waters in No. 17517, rates on chert, clay, sand and gravel within the state of Georgia, and related cases, after further hearing following the original report of the commission.

The report recommends a finding by the commission prescribing maximum reasonable interstate rates, based on single-line and joint-line distance scales plus certain arbitraries, for uniform application on sand and gravel from Montgomery, Ala., and Chattanooga, Tenn., and on slag from Birmingham and certain other points in Alabama, to destinations in Florida peninsula south of the Seaboard Air Line from Jacksonville to River Junction, and also for application on sand, gravel, crushed stone and slag between points in Georgia and points in Florida south of the Seaboard Air Line.

Arbitraries are also proposed over the rates to be prescribed for "standard" lines to be accorded to certain short lines.

The recommended rates are:

| | |
|---|---|
| 30 miles and under | 25 |
| 60 miles and over 30 | 35 |
| 100 miles and over 60 | 45 |
| 150 miles and over 100 | 55 |
| 200 miles and over 150 | 65 |
| 250 miles and over 200 | 75 |
| 300 miles and over 250 | 80 |
| Over 300 miles | 85 |

Rates on gravel from Montgomery and Chattanooga to destinations in the Florida peninsula, as defined, would be found unduly prejudicial, according to the examiner's recommendations, to the extent they exceed, distance considered, rates contemporaneously maintained on slag from Gadsden, Anniston and certain other slag producing points in Alabama and from Copperhill, Tenn., to the same destinations.

## Sand to Chicago Heights

ON a finding that the rate on sand from Willow Creek and Crisman, Ind., to Chicago Heights, Ill., was not and is not unreasonable, the commission, by division 3, has dismissed the complaint in No. 18710, Manufacturers' Association of Chicago Heights vs. Chicago Heights Terminal Transfer et al., mimeographed. Charges were collected at a combination rate of 75 cents, composed of 50 cents for the line haul over the Michigan Central to Chicago Heights, plus a 25-cent switching charge of the Chicago Heights Terminal Transfer. Complainant contended the rate charged had been and was unreasonable to the extent that it exceeded or might exceed 50 cents. The commission said the rate assailed compared favorably with rates prescribed in Penn. Sand and Gravel Prod. Assn. vs. B. & O., 104 I. C. C. 717, and Chicago Gravel Co. vs. A. T. & S. F., 118 I. C. C. 633.

## Kansas Gas Belt Cement Rates Ordered Revised

THE Interstate Commerce Commission, by division 1, in No. 15117, Iola Cement Mills Traffic Association et al. vs. Atchison, Topeka & Santa Fe et al., mimeographed, has ordered a revision of rates on cement in the Kansas gas belt and Cement City-Bonner Springs districts. The report also covers No. 15138, Atlas Portland Cement Co. of Kansas vs. Same.

The report has three distinct features. It finds the interstate rate of 11 cents, from points in the Kansas gas belt to specified destinations in the Kansas City, Mo.-Kan., switching district, not unreasonable. It finds undue prejudice of Kansas gas belt points and undue preference of Cement City (Sugar Creek), Mo., and Bonner Springs and Sunflower, Kan., to result from the relation of interstate rates, from the points of origin mentioned to the designations set forth. It finds undue prejudice of Kansas gas belt points, undue preference of Cement City, Bonner Springs and Sunflower, and unjust discrimination against interstate commerce to result from the relation of the interstate rates from the gas belt points and intrastate rates on like traffic from Cement City, Bonner Springs and Sunflower to the destinations mentioned.

This report of the commission differs from the proposed report made by the examiner.

The complainants in the title complaint have cement plants at Chanute, Fredonia, Mildred and Humboldt, Kan., and Dewey, Okla. The Atlas company has its plant at Independence, Kan. Those points, collectively, are known as Kansas gas belt points. They are generally grouped in respect of interstate cement rates. Their complaints allege that the 11-cent rate from points in the gas belt to points within the Kansas City switching district are unreasonable and, as compared with the rates from Sugar Creek, Bonner Springs and Sunflower, unduly prejudicial to them and unduly preferential of the manufacturers at Sugar Creek, Bonner Springs and Sunflower.

A joint hearing was held by the federal and the Kansas commissions. The report says the Missouri authorities were notified of the proceeding. The Kansas commission was interested because it had before it complaints alleging that the Kansas rates from points in Kansas in the gas belt to Kansas City, Kan., including Argentine, Glen Park and Rosedale, were unreasonable and unduly preferential of their competitors shipping from Sugar Creek, Bonner Springs and Sunflower.

# The Rock Products Market

## Wholesale Prices of Crushed Stone

**Prices given are per ton, F.O.B., at producing point or nearest shipping point**

### Crushed Limestone

| City or shipping point | Screenings, ¼ inch down | ½ inch and less | ¾ inch and less | 1½ inch and less | 2½ inch and less | 3 inch and larger |
|---|---|---|---|---|---|---|
| **EASTERN:** | | | | | | |
| Buffalo, N. Y. | 1.30 | 1.30 | 1.30 | 1.30 | 1.30 | 1.30 |
| Chaumont, N. Y. | .50 | 1.75 | 1.75 | 1.50 | 1.50 | 1.50 |
| Chazy, N. Y. | .75 | ..... | 1.60 | 1.30 | 1.30 | 1.30 |
| Coldwater, N. Y.—Dolomite | | | 1.50 all sizes | | | |
| Danbury, Conn. | 2.25 | 2.25 | 2.00 | 1.75 | 1.50 | ..... |
| Dundas, Ont. | 3.04 | 1.05 | 1.05 | .90 | .90 | .90 |
| Frederick, Md. | .50@1.00 | 1.35@1.50 | 1.15@1.50 | 1.10@1.15 | 1.05@1.10 | 1.05@1.10 |
| Munns, N. Y. | 1.00 | 1.50 | 1.25 | 1.30 | 1.25 | ..... |
| Northern New Jersey | 1.60 | 1.50@1.80 | 1.30@2.00 | 1.40@1.60 | 1.40@1.60 | ..... |
| Prospect, N. Y. | 1.00 | 1.50 | 1.40 | 1.30 | 1.30 | ..... |
| Rochester, N. Y. | 1.50 | 1.50 | 1.50 | 1.50 | 1.50 | 1.50 |
| Walford, Penn. | ..... | ..... | 1.35h | 1.35h | 1.35h | 1.35h |
| Watertown, N. Y. | 1.00 | ..... | 1.75 | 1.50 | 1.50 | 1.50 |
| Western New York | .85 | 1.25 | 1.25 | 1.25 | 1.25 | 1.25 |
| **CENTRAL:** | | | | | | |
| Afton, Mich. | ..... | ..... | .50 | .75 | ..... | 1.50 |
| Alton, Ill. | 1.85 | ..... | 1.85 | ..... | ..... | ..... |
| Buffalo and Linwood, Iowa | 1.10 | ..... | 1.45 | 1.25 | 1.30 | 1.30 |
| Chasco, Ill. | 1.00@1.30 | ..... | 1.00@1.15 | ..... | 1.00@1.15 | ..... |
| Columbia, Krause, Valmeyer, Ill. | 1.10@1.50 | 1.10@1.25 | 1.20@1.35 | 1.10@1.35 | 1.10@1.35 | ‖1.25 |
| Flux (Valmeyer) | 1.10@1.50 | ..... | ..... | 1.75 | ..... | 1.75 |
| Greencastle, Ind. | 1.25 | 1.25 | 1.15 | 1.05 | .95 | .95 |
| Lannon, Wis. | .80 | 1.00 | 1.00 | .90 | .90 | .90 |
| McCook, Ill. | 1.00 | 1.25 | 1.25 | 1.25 | 1.25 | 1.25 |
| River Rouge, Mich. | 1.20 | 1.20 | 1.20 | 1.20 | 1.20 | 1.20 |
| Milltown, Ind. | ..... | .90@1.00 | 1.00@1.10 | .90@1.00 | .85@ .90 | .85@ .90 |
| Mt. Vernon, Ill. | 1.10@1.20 | 1.00 | 1.00 | 1.00 | 1.00 | ..... |
| Sheboygan, Wis. | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 | ..... |
| Stone City, Iowa | ..... | ..... | 1.20 | 1.10 | 1.00 | ..... |
| St. Vincent de Paul, Que. | .70 | 1.35 | 1.00 | .85 | .80 | 1.25 |
| Toledo, Ohio | 1.60 | 1.70 | 1.70 | 1.60 | 1.60 | 1.60 |
| Toronto, Ont. | 1.55 | 2.05 | 2.05 | 1.90 | 1.90 | 1.90 |
| Waukesha, Wis. | .90 | ..... | ..... | .90 | .90 | .90 |
| Wisconsin Points | .50 | ..... | 1.00 | .90 | .90 | ..... |
| Youngstown, Ohio | .70j | 1.25l@1.35h | 1.25l@1.35h | 1.25l@1.35h | 1.25l@1.35h | 1.25l@1.35h |
| **SOUTHERN:** | | | | | | |
| Alderson, W. Va. | .50 | 1.40 | 1.35 | 1.25 | 1.20 | 1.15 |
| Atlas, Ky. | .50 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Brooksville, Fla. | .75 | ..... | 2.65 | 2.65 | 2.40 | 2.00 |
| Cartersville, Ga. | ..... | 1.50 | 1.50 | 1.35 | 1.05 | ..... |
| Chico and Bridgeport, Tex. | 1.00 | 1.30 | 1.25 | 1.20 | 1.05 | 1.00 |
| El Paso, Tex. | 1.00 | 1.00 | 1.00 | 1.00 | ..... | ..... |
| Ft. Springs, W. Va. | .50 | 1.35 | 1.35 | 1.20 | 1.20 | ..... |
| Graystone, Ala. | | | Crusher run, screened, $1 per ton | | | |
| Kendrick and Santos, Fla. | | | 3½ in. and less, $1 per ton | | | |
| Ladds, Ga. | ..... | 1.65 | 1.65 | 1.35 | 1.15 | 1.15 |
| New Braunfels, Tex. | .60 | 1.25 | 1.10 | .90 | .90 | .90 |
| Rocky Point, Va. | .50@ .75 | 1.40@1.60 | 1.30@1.40 | 1.15@1.25 | 1.10@1.20 | 1.00@1.05 |
| **WESTERN:** | | | | | | |
| Atchison, Kan. | .50 | 1.90 | 1.90 | 1.90 | 1.90 | 1.80 |
| Blue Springs & Wymore, Neb. | .25 | 1.45 | 1.45 | 1.35c | 1.25d | 1.20 |
| Cape Girardeau, Mo. | 1.25 | 1.25 | 1.25 | 1.25 | 1.00 | ..... |
| Rock Hill, St. Louis Co., Mo. | 1.35 | 1.35 | 1.35 | 1.25 | 1.25 | 1.50 |
| Sugar Creek, Mo. | 1.15* | 1.60† | 1.60‡ | 1.60§ | 1.00¶ | ..... |

### Crushed Trap Rock

| City or shipping point | Screenings, ¼ inch down | ½ inch and less | ¾ inch and less | 1½ inch and less | 2½ inch and less | 3 inch and larger |
|---|---|---|---|---|---|---|
| Branford, Conn. | .80 | 1.70 | 1.45 | 1.20 | 1.05 | ..... |
| Duluth, Minn. | .90 | 2.00 | 1.75 | 1.55 | 1.25 | 1.25 |
| Dwight, Calif. | 1.00 | 1.00 | 1.00 | .90 | .90 | ..... |
| Eastern Maryland | 1.00 | 1.60 | 1.60 | 1.50 | 1.35 | 1.35 |
| Eastern Massachusetts | .85 | 1.75 | 1.75 | 1.25 | 1.25 | 1.25 |
| Eastern New York | .75 | 1.25 | 1.25 | 1.25 | 1.25 | 1.25 |
| Eastern Pennsylvania | 1.10 | 1.70 | 1.60 | 1.50 | 1.35 | 1.35 |
| Knippa, Tex. | 2.50 | 2.00 | 1.55 | 1.25 | 1.15 | ..... |
| New Britain, Plainville, Rocky Hill, Wallingford, Meriden, Mt. Carmel, Conn. | .80 | 1.70 | 1.45 | 1.20 | 1.05 | ..... |
| Northern New Jersey | 1.60 | 2.10 | 1.90 | 1.50 | 1.50 | ..... |
| Oakland and El Cerito, Calif. | 1.00 | 1.00 | 1.00 | .90 | .90 | ..... |
| Richmond, Calif. | .75 | ..... | 1.00 | 1.00 | 1.00 | ..... |
| San Diego, Calif. | .50@ .75 | 1.25@1.50 | 1.25@1.50 | 1.10@1.25 | 1.10@1.25 | ..... |
| Springfield, N. J. | 1.70@1.80 | 2.10@2.20 | 2.00@2.10 | 1.60@1.70 | 1.60@1.70 | 1.50@1.60 |
| Toronto, Ont. | ..... | 3.58@4.05 | 3.05@3.80 | ..... | ..... | ..... |
| Westfield, Mass. | .60 | 1.50 | 1.35 | 1.20 | 1.10 | ..... |

### Miscellaneous Crushed Stone

| City or shipping point | Screenings, ¼ inch down | ½ inch and less | ¾ inch and less | 1½ inch and less | 2½ inch and less | 3 inch and larger |
|---|---|---|---|---|---|---|
| Berlin, Utley, Montello and Red Granite, Wis.—Granite | 1.80 | 1.70 | 1.50 | 1.40 | 1.40 | ..... |
| Columbia, S. C. | ..... | 2.00 | 1.90 | 1.90 | 1.75 | ..... |
| Eastern New York—Syenite | .75 | 1.25 | 1.25 | 1.25 | 1.25 | 1.25 |
| Eastern Penn.—Sandstone | 1.35 | 1.70 | 1.65 | 1.40 | 1.40 | 1.40 |
| Eastern Penn.—Quartzite | 1.20 | 1.35 | 1.25 | 1.20 | 1.20 | 1.20 |
| Emathla, Fla. | | | Crushed flint rock, 2.50 per cu. yd. | | | |
| Graystone, Ala.—Granite | .50 | ..... | ..... | ..... | ..... | ..... |
| Lithonia, Ga.—Granite | .75a | 2.00b | 1.75 | 1.40 | 1.35 | ..... |
| Lohrville, Wis.—Granite | 1.65 | 1.70 | 1.65 | 1.45 | 1.50 | ..... |
| Middlebrook, Mo. | 3.00@3.50 | ..... | 2.00@2.25 | 2.00@2.25 | ..... | 1.25@3.00 |
| Richmond, Calif.—Quartzite | .75 | ..... | 1.00 | 1.00 | 1.00 | ..... |
| Rochester, N. Y. | | | Dolomite, all sizes, $1.40 per ton | | | |
| Somerset, Penn. (sand-rock) | | | 1.50 to 1.85 | | | |
| Toccoa, Ga.—Granite | ..... | 1.30 | ..... | ..... | ..... | ..... |

*¼ to ½ in. †¼ to 1 in. ‡¾ to 1¼ in. §¼ to 2¼ in. ¶Dust.
‖Rip rap per ton. (a) Sand. (b) to ⅛ in. (c) 1 in., 1.40. (d) 2in., 1.30. (h) Less 10c discount. (j) Less 10% net ton. (l) Less .05. (e) Agstone to June 15, 1927. [1] ¾ to ¼ in. [2] 1 to ¾ in. [3] 1½ to ¼ in. (A) Plus 4% sales tax, less 2% discount 30 days.

### Agricultural Limestone

**(Pulverized)**

| | |
|---|---|
| Alderson, W. Va.—Analysis, 90% $CaCO_3$; 90% thru 50 mesh | 1.50 |
| Alton, Ill.—Analysis 99% $CaCO_3$, 0.3% $MgCO_3$; 90% thru 100 mesh | 4.50 |
| Atlas, Ky.—90% thru 100 mesh | 2.00 |
| 50% thru 100 mesh | 1.00 |
| Bettendorf and Moline, Ill.—Analysis, $CaCO_3$, 97%; 2% $MgCO_3$; 50% thru 100 mesh, 1.50; 50% thru 4 mesh | 1.50 |
| Blackwater, Mo.—100% thru 4 mesh | 1.00 |
| Branchton, Penn.—100% thru 20 mesh; 60% thru 100 mesh; 45% thru 200 mesh | 5.00 |
| Cape Girardeau, Mo.—Analysis, $CaCO_3$, 93½%; $MgCO_3$, 3½%; 90% thru 50 mesh | 1.50 |
| Cartersville, Ga.—50% thru 50-mesh | 1.50 |
| Charleston, W. Va.—Marl, per ton, bulk | 3.00 |
| Chaumont, N. Y.—Pulverized limestone, bags, 4.00; bulk | 2.50 |
| Chico, Tex.—50% thru 50 mesh, 1.75; 50% thru 100 mesh | 2.25 |
| Cypress, Ill.—90% thru 100 mesh | 1.35 |
| Ft. Springs, W. Va.—50% thru 4 mesh | 1.50 |
| Hartford, Conn.—Paper bags, 4.25; cloth bags, 4.75; bulk | 3.25 |
| Hillsville, Penn.—Analysis, 94% $CaCO_3$; 1.40% $MgCO_3$; 75% thru 100 mesh; sacked | 5.00 |
| Hot Springs and Greensboro, N. C.—Analysis, $CaCO_3$, 98-99%; $MgCO_3$, 42%; pulverized; 67% thru 200 mesh; bags | 3.95 |
| Bulk | 2.70 |
| Jamesville, N. Y.—Analysis 89% $CaCO_3$, 4% $MgCO_3$; pulverized; bags, 4.25; bulk | 2.75 |
| Joliet, Ill.—Analysis, 52% $CaCO_3$; 44% $MgCO_3$; 90% thru 100 mesh | 3.50 |
| Knoxville, Tenn.—80% thru 100 mesh; bags, 3.95; bulk | 2.70 |
| Ladds, Ga.—Analysis, $CaCO_3$, 64%; $MgCO_3$, 32%; pulverized; 50% thru 50 mesh | 1.50@ 2.75 |
| Marblehead, Ohio—Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$; 60% thru 100 mesh; 70% thru 50 mesh; 100% thru 10 mesh; 80 lb. paper sacks, 5.00; bulk | 3.50 |
| Marlbrook, Va.—Analysis, 80% $CaCO_3$; 10% $MgCO_3$; bulk, 1.75; bags | 3.75 |
| Marl—Analysis, 90% $CaCO_3$; 10% $MgCO_3$; bulk, 2.25; bags | 4.00 |
| Marion, Va.—Analysis, 90% $CaCO_3$, pulverized, per ton | 2.00 |
| Middlebury, Vt.—Analysis, 90.05% $CaCO_3$; 90% thru 50 mesh | 6.00 |
| Milltown, Ind.—Analysis, 94.50% $CaCO_3$, 33% thru 50 mesh, 40% thru 50 mesh; bulk | 1.35@ 1.60 |
| Olive Hill, Ky.—90% thru 4 mesh | 1.00 |
| Piqua, Ohio—Total neutralizing power 95.3%; 99% thru 10, 60% thru 50; 50% thru 100 | 2.50@ 2.75 |
| 100% thru 10, 90% thru 50, 80% thru 100; bags, 5.10; bulk | 3.60 |
| 99% thru 100, 85% thru 200; bags, 7.00; bulk | 5.50 |
| Rocky Point, Va.—Analysis, $CaCO_3$, 95%; 50% thru 200 mesh, burlap bags, 3.50; paper, 3.25; bulk | 2.00 |
| Syracuse, N. Y.—Analysis 89% $CaCO_3$; $MgCO_3$, 4%; bags, 4.25; bulk | 2.75 |
| Toledo, Ohio—30% thru 50 mesh | 2.25 |
| Watertown, N. Y.—Analysis, 96-99% $CaCO_3$; 50% thru 100 mesh; bags, 4.00; bulk | 2.50 |
| West Stockbridge, Mass.—Analysis, 90% $CaCO_3$, 50% thru 100 mesh; cloth bags, 4.75; paper, 4.25; bulk | 3.25 |
| Carload, 7.50; less than carload | 9.00 |

### Agricultural Limestone

**(Crushed)**

| | |
|---|---|
| Alton, Ill.—Analysis, 99% $CaCO_3$, 0.3% $MgCO_3$; 50% thru 4 mesh | 3.00 |
| Atlas, Ky.—90% thru 4 mesh | 1.00 |
| Bedford, Ind.—Analysis, 98.5% $CaCO_3$, 0.5%; $MgCO_3$; 90% thru 10 mesh | 1.50 |

(Continued on next page)

## Agricultural Limestone

| | |
|---|---|
| Bridgeport and Chico, Texas—Analysis, 94% $CaCO_3$, 2% $MgCO_3$; 90% thru 100 mesh | 3.50 |
| Chicago, Ill. — 50% thru 100 mesh; 90% thru 4 mesh | .80 |
| Columbia, Krause, Valmeyer, Ill. — Analysis, 90% $CaCO_3$; 100% thru 4 mesh | 1.10@ 1.50 |
| Cypress, Ill.—90% thru 50 mesh, 50% thru 100 mesh, 90% thru 50 mesh, 90% thru 4 mesh, 50% thru 4 mesh | 1.35 |
| Danbury, Conn.—Analysis, 79% $CaCO_3$, 11% $MgCO_3$; 60% thru 100 mesh; 80% thru 50 mesh; 100% thru 4 mesh; bags, 4.25; bulk | 3.25 |
| Dundas, Ont.—Analysis, 54% $CaCO_3$; $MgCO_3$, 43%; 50% thru 50 mesh | 1.00 |
| Ft. Springs, W. Va.—Analysis, 90% $CaCO_3$; 90% thru 50 mesh | 1.50 |
| Kansas City, Mo. — 50% thru 100 mesh | 1.00 |
| Lannon, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 99% thru 10 mesh; 46% thru 60 mesh | 2.00 |
| Screenings (¼ in. to dust) | 1.00 |
| Marblehead, Ohio—Analysis, 83.54% $CaCO_3$, 14.92¼ $MgCO_3$, 32% thru 100 mesh; 51% thru 50 mesh; 83% thru 10 mesh; 100% thru 4 mesh (meal) bulk | 1.60 |
| Mayville, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 50% thru 50 mesh | 1.85@ 2.35 |
| McCook, Ill.—90% thru 4 mesh | .90 |
| Middlepoint, Bellevue, Kenton, Ohio; Monroe, Mich.; Huntington and Bluffton, Ind.—Analysis, 42% $CaCO_3$, 54% $MgCO_3$; meal, 100% thru 4 mesh; 20% thru 100 mesh | 1.50 |
| Moline, Ill., and Bettendorf, Iowa—Analysis, 97% $CaCO_3$, 2% $MgCO_3$; 50% thru 100 mesh; 50% thru 4 mesh | 1.50 |
| Moundsville, Va. — Analysis, 62.54% $CaCO_3$; $MgCO_3$, 35.94%, 100% thru 20 mesh; 50% thru 100 mesh, bags | 5.00 |
| Pixley, Mo. — Analysis, 96% $CaCO_3$; 50% thru 50 mesh | 1.25 |
| 50% thru 100 mesh; 90% thru 50 mesh; 50% thru 50 mesh; 90% thru 4 mesh; 50% thru 4 mesh | 1.65 |
| River Rouge, Mich. — Analysis, 54% $CaCO_3$, 40% $MgCO_3$; bulk | .80@ 1.40 |
| Stone City, Iowa — Analysis, 98% $CaCO_3$; 50% thru 50 mesh | .75 |
| Tulsa, Okla.—Analysis $CaCO_3$, 86.15%, 1.25% $MgCO_3$, all sizes | 1.25 |
| Waukesha, Wis.—90% thru 100 mesh, 4.50; 50% thru 100 mesh | 2.30 |

## Pulverized Limestone for Coal Operators

| | |
|---|---|
| Hillsville, Penn., sacks, 4.50; bulk | 3.00 |
| Joliet, Ill.—Analysis, 55% $CaCO_3$; 45% $MgCO_3$; 95% thru 100 mesh; bulk | 3.50 |
| Piqua, Ohio, sacks, 4.50@5.00; bulk | 3.00@ 3.50 |
| Rocky Point, Va.—92% thru 100, mesh, bulk | 2.25@ 3.50 |
| Waukesha, Wis.—90% thru 100 mesh, bulk | 4.50 |

*Bags extra.

## Glass Sand

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. producing plant.

| | |
|---|---|
| Buffalo, N. Y. | 2.00@ 2.50 |
| Cedarville and S. Vineland, N. J.—Damp | 1.75 |
| Dry | 2.25 |
| Estill Springs and Sewanee, Tenn. | 1.50 |
| Franklin, Penn. | 2.00 |
| Gray Summit and Klondike, Mo. | 1.75@ 2.00 |
| Klondike, Mo. | 2.00 |
| Los Angeles, Calif.—Washed | 5.00 |
| Mendota, Va. | 2.25@ 2.50 |
| Michigan City, Ind. | .35 |
| Mineral Ridge and Ohlton, Ohio | 2.50 |
| Oceanside, Calif. | 3.00 |
| Ohlton, Ohio | 2.50 |
| Pittsburgh, Penn. | 3.00@ 4.00 |
| Red Wing, Minn. | 1.50 |
| Ridgway, Penn. | 2.50 |
| Rockwood, Mich. | 2.75@ 3.25 |
| Round Top, Md. | 2.00 |
| San Francisco, Calif. | 4.00@ 5.00 |
| Silica, Va. | 2.50 |
| St. Louis, Mo. | 2.00 |
| Sewanee, Tenn. | 1.50 |
| Thayers, Penn. | 2.50 |
| Zanesville, Ohio | 2.50 |

## Miscellaneous Sands

| City or shipping point | Roofing sand | Traction |
|---|---|---|
| Beach City, Ohio | | 1.75 |
| Columbus, Ohio | | .15@ .30 |
| Dresden, Ohio | | 1.25 |
| Eau Claire, Wis. | 4.25 | |

(Continued on next page)

# Wholesale Prices of Sand and Gravel

**Prices given are per ton, F.O.B., producing plant or nearest shipping point**

## Washed Sand and Gravel

| City or shipping point | Fine Sand, 1/10 in. down | Sand, ¼ in. and less | Gravel, ½ in. and less | Gravel, 1 in. and less | Gravel, 1½ in. and less | Gravel, 2 in. and less |
|---|---|---|---|---|---|---|
| **EASTERN:** | | | | | | |
| Ambridge & So. H'g'ts, Penn. | 1.25 | 1.25 | 1.15 | .85 | .85 | .85 |
| Attica and Franklinville, N. Y. | .65 | .65 | | | .65 | |
| Boston, Mass.‡ | 1.40 | 1.40 | 2.25 | | 2.25 | 2.25 |
| Buffalo, N. Y. | 1.10 | 1.05 | 1.05 | 1.05 | | 1.05 |
| Erie, Penn. | | 1.00* | | 1.50* | 1.75* | |
| Farmingdale, N. J. | .80 | .70 | 1.15 | 1.40 | | |
| Leeds Junction, Me. | | .50 | 1.75 | | 1.25 | 1.00c |
| Machias Jct., N. Y. | .75 | .75 | .85 | .75 | .75 | .75 |
| Montoursville, Penn. | 1.00 | .90 | .85 | .75 | .75 | .75 |
| Northern New Jersey | .50 | .50 | 1.00@1.25 | 1.00@1.25 | 1.00@1.25 | |
| Portland, Me. | | 1.00 | 2.25 | | 2.00 | |
| Shining Point, Penn. | | | 1.00 | 1.00 | 1.00 | 1.00 |
| Somerset, Penn. | | 2.00 | | | | |
| South Heights, Penn. | 1.25 | 1.25 | .85 | .85 | .85 | .85 |
| Washington, D. C. | .85 | .85 | 1.70 | 1.50 | 1.30 | 1.30 |
| **CENTRAL:** | | | | | | |
| Aurora, Yorkville, Sheridan, Oregon, Moronts, Ill. | .50 | .40 | .20 | .45 | .60 | .55 |
| Algonquin and Beloit, Wis. | .50 | .40 | .60 | .60 | .60 | .60 |
| Appleton and Mankato, Minn. | | .45 | 1.25 | 1.25 | 1.25 | 1.25 |
| Attica, Ind. | | | All sizes .75@.85 | | | |
| Barton, Wis. | | .50 | .75 | .75 | .75 | .75 |
| Chicago district, Ill. | .70 | .55 | .55 | .60 | .60 | .60 |
| Columbus, Ohio | | .75 | .75 | .75 | .75 | |
| Des Moines, Iowa | | .30 | 1.30 | 1.30 | 1.30 | 1.30 |
| Eau Claire, Wis. | .40 | .40 | .65 | .90 | .90 | |
| Elkhart Lake, Wis. | .50 | .30 | .30 | .60 | .50 | .40 |
| Ferrysburg, Mich. | | .50@ .80 | .60@1.00 | .60@1.00 | | .50@1.25 |
| Ft. Dodge, Iowa | .85 | .85 | 2.05 | 2.05 | 2.05 | 2.05 |
| Grand Haven, Mich. | | .60@ .80 | .70@ .90 | .70@ .90 | | .70@ .90 |
| Grand Rapids, Mich. | | .50 | | .80 | .80 | .70 |
| Hamilton, Ohio | | 1.00 | | | 1.00 | |
| Hersey, Mich. | | .50 | | .70 | | .70 |
| Humboldt, Iowa | .50 | .50 | 1.50 | 1.50 | 1.50 | 1.50 |
| Indianapolis, Ind. | .60 | .60 | | .90 | .75@1.00 | .75@1.00 |
| Joliet, Plainfield & Hammond, Ill. | .60 | .50 | .50 | .60 | .60 | .60 |
| Mason City, Iowa | .50@ .60 | .50@ .60 | 1.30 | 1.30 | 1.20 | 1.20 |
| Mankato, Minn. | | | | 1.25 | 1.25 | 1.25 |
| Mattoon, Ill. | | | .75@.85 all sizes | | | |
| Milwaukee, Wis. | .96 | .91 | 1.06 | 1.06 | 1.06 | 1.06 |
| Minneapolis, Minn. | .65* | .65* | 1.75* | 1.75* | 1.75* | 1.75* |
| Moline, Ill. | .60@ .85 | .60@ .85 | 1.00@1.20 | 1.00@1.20 | 1.00@1.20 | 1.00@1.20 |
| Northern New Jersey | .40@ .50 | .40@ .50 | 1.40 | 1.35 | 1.25 | |
| Pittsburgh, Penn. | 1.25 | 1.25 | .85 | .85 | .85 | .85 |
| Silverwood, Ind. | .75 | .75 | .75 | .75 | .75 | .75 |
| St. Louis, Mo. | 1.20e | 1.45f | 1.55a | 1.45 | 1.45 | 1.45 |
| St. Paul, Minn. | .35 | .35 | 1.25 | 1.25 | | 1.25 |
| Terre Haute, Ind. | .75 | .60 | .85 | .80 | .75 | .75 |
| Wolcottville, Ind. | .75 | .75 | .75 | .75 | .75 | .75 |
| Waukesha, Wis. | | .45 | .60 | .60 | .65 | .65 |
| Winona, Minn. | .50 | .40 | .50 | 1.00 | 1.00 | 1.15 |
| Zanesville, Ohio | | .60 | .50 | .60 | .80 | |
| **SOUTHERN:** | | | | | | |
| Charleston, W. Va. | 1.40 | 1.40 | 1.40 | 1.40 | 1.40 | 1.40 |
| Brewster, Fla. | .45 | .45 | 2.25 | | | |
| Brookhaven, Miss. | 1.25 | .70 | 1.25 | 1.00 | .70 | .70 |
| Chattahoochie River, Fla. | | .70 | | 1.75 | | |
| Eustis, Fla. | | .50@ .60 | | | | |
| Ft. Worth, Texas | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 |
| Knoxville, Tenn. | 1.00 | 1.00 | 1.20 | 1.20 | 1.20 | 1.00 |
| Macon, Ga. | | .50 | | | .85 | |
| New Martinsville, W. Va. | 1.00 | .90@1.00 | | 1.20@1.30 | | .80@ .90 |
| Roseland, La. | .25 | .20 | 1.00 | 1.25 | .60 | .60 |
| **WESTERN:** | | | | | | |
| Kansas City, Mo. | | .70@ .75 | | | | |
| Crushton, Durbin, Kincaid, Largo, Rivas, Calif. | .10@ .40 | .10@ .40 | .50@1.00 | .50@1.00 | .50@1.00 | .50@1.00 |
| Oregon City, Ore. | 1.25* | 1.25* | 1.25* | 1.25* | 1.25* | 1.25* |
| Phoenix, Ariz. | 1.25 | 1.00 | 2.00 | 1.50 | 1.75 | 1.00 |
| Pueblo, Colo. | .70 | .60 | | 1.20 | | 1.15 |
| San Diego, Calif. | | .40@ .50 | .80@1.00 | .80@1.00 | .65@ .80 | .65@ .80 |
| Steilacoom, Wash.* | .50 | .25@ .50 | .25@ .50 | .25@ .50 | .25@ .50 | .25@ .50 |

## Bank Run Sand and Gravel

| City or shipping point | Fine Sand, 1/10 in. down | Sand, ¼ in. and less | Gravel, ½ in. and less | Gravel, 1 in. and less | Gravel, 1½ in. and less | Gravel, 2 in. and less |
|---|---|---|---|---|---|---|
| Algonquin and Beloit, Wis. | | | Dust to 3 in., .40 | | | |
| Brookhaven, Miss. | | | | | | .50 |
| Buffalo, N. Y. | 1.10 | .95 | | .85 | | .85 |
| Burnside, Conn. | .75 | | | | | |
| Des Moines, Iowa | .50 | | | | | |
| Dresden, Ohio | .50 | .50 | .60@ .80 | .65 | .60 | .60 |
| East Hartford, Conn. | .80*d | | | | | |
| Gainesville, Texas | | | | | .55 | |
| Grand Rapids, Mich. | | | | .50 | | |
| Hamilton, Ohio | | | | | .68 | |
| Hersey, Mich. | | | | .50 | | |
| Indianapolis, Ind. | | | Mixed gravel for concrete work, at .65 | | | |
| Lindsay, Texas | | 1.10 | | | .55 | |
| Macon, Ga. | .35 | | | | | |
| Mankato, Minn. | .30 | | | | | |
| Moline, Ill. (b) | .60 | .60 | Concrete gravel, 50% G., 50% S., 1.00 | | | |
| Oregon City, Ore. | 1.25* | 1.25* | 1.25* | 1.25* | 1.25* | 1.25* |
| Ottawa, Oregon, Moronts and Yorkville, Ill. | | | Ave. .60 per ton all sizes | | | |
| Roseland, La. | | | | | .50 | |
| Somerset, Penn. | | 1.85@2.00 | | 1.50@1.75 | | |
| St. Louis, Mo. | | | Mine run gravel, 1.55 per ton | | | |
| Summit Grove, Ind. | .50 | .50 | .50 | .50 | .50 | .54 |
| Winona, Minn. | .60 | .60 | .60 | .60 | .60 | .60 |
| York, Penn. | 1.10 | 1.00 | | | | |

*Cubic yd. ‡Delivered on job by truck. (a) ⅜-in. down. (b) River run. (c) 2½-in. and less "By truck only. (d) Delivered in Hartford, Conn., $1.50 per yd. (e) Mississippi River. (f) Meramee River.

## Core and Foundry Sands

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. producing plant.

| City or shipping point | Molding, fine | Molding, coarse | Molding, brass | Core | Furnace lining | Sand blast | Stone sawing |
|---|---|---|---|---|---|---|---|
| Aetna, Ill. | | | | .30@ .35 | | | |
| Albany, N. Y. | 2.00 | 2.00 | 2.25 | 1.50 | | 3.75 | |
| Arenzville, Ill. | 1.50@1.75 | | | 1.00 | | | |
| Beach City, Ohio | 1.75 | 1.75 | | 1.75 | 1.75@2.00 | | |
| Buffalo, N. Y. | 1.50 | 1.50 | | 2.00@2.50 | | | |
| Columbus, Ohio | 1.50@2.00 | 1.25@1.50 | 2.00 | .30 | 1.75@2.00 | 2.75@4.50 | |
| Dresden, Ohio | 1.25@1.50 | 1.25@1.50 | 1.50 | 1.00 | 1.25 | | |
| Eau Claire & Chippewa Falls, Wis. | | | | | | 3.00 | |
| Elco & Tamms, Ill. | Ground silica per ton in carloads—18.00@31.00 | | | | | | |
| Estill Springs and Sewanee, Tenn. | 1.25 | | | 1.25 | | 1.35@1.50 | |
| Franklin, Penn. | 1.75 | 1.75 | | 1.75 | 1.75 | | |
| Kasota, Minn. | | | | | | | 1.00 |
| Klondike, Mo. | | | | 2.00 | 2.00 | | 2.00 |
| Massillon, O. (a) | 2.00@2.25 | | | | 2.00@3.00 | | |
| Mendota, Va. | Ground flint or silex—16.00@20.00 per ton | | | | | | |
| Michigan City, Ind. | | | | .30@ .35 | | | |
| Millville, N. J. | | | | 1.75b | | 3.50 | |
| Montoursville, Penn. | | | | 1.35@1.60 | | | |
| New Lexington, O. | 2.00 | 1.25 | | | | | |
| Ohlton, Ohio | 1.75b | 1.75b | | 2.00b | 1.75b | 1.75b | |
| Red Wing, Minn. (d) | | | | | 1.50 | 3.00 | 1.50 |
| Ridgway, Penn. | 1.50 | 1.50 | 1.75@2.00c | | | | |
| Round Top, Md. | | | | 1.60 | | 2.25 | |
| San Francisco, Calif.[1] | 3.50† | 5.00† | 3.50† | 3.50@5.00† | 3.50@5.00† | 3.50@5.00† | |
| Silica, Va. | Potters' flint per ton, 9.00@10.00 | | | | | | |
| Thayers, Penn. | 1.25 | 1.25 | | 2.00 | | | |
| Utica, Ill. | .50 | .60 | | .65 | .75 | | |
| Utica, Penn. | 1.75 | 1.75 | | 2.00 | | | |
| Warwick, Ohio | 1.75*@2.00 | 1.75*@2.00 | *1.50 | 1.75*@2.00 | 1.75*@2.00 | | |
| Zanesville, Ohio | 2.00 | 1.50 | 2.00 | 2.50 | 2.50 | | |

*Green. †Fresh water washed, steam dried. [1]Core, washed and dried, 2.50. (b) Damp. (c) Shipped from Albany. (g) Dry. (a) Green, 1.50@1.75. (d) Filter sand, 3.00.

## Crushed Slag

| City or shipping point | Roofing | ¼ in. down | ½ in. and less | ¾ in. and less | 1½ in. and less | 2½ in. and less | 3 in. and larger |
|---|---|---|---|---|---|---|---|
| **EASTERN:** | | | | | | | |
| Buffalo, N. Y., Erie and Dubois, Pa. | 2.25 | 1.25 | 1.35 | 1.25 | 1.25 | 1.25 | 1.25 |
| Eastern Penn. | 2.50 | 1.20 | 1.50 | 1.20 | 1.20 | 1.20 | 1.20 |
| Northern N. J. | 2.50 | 1.20 | 1.50 | 1.20 | 1.20 | 1.20 | 1.20 |
| Reading, Penn. | 2.50 | 1.25 | | 1.50 | | | |
| Western Penn. | 2.50 | 1.25 | 1.50 | 1.25 | 1.25 | 1.25 | 1.25 |
| **CENTRAL:** | | | | | | | |
| Ironton, Ohio | 2.05* | 1.30* | 1.80* | 1.45* | | 1.45* | |
| Jackson, Ohio | 1.75* | 1.05* | 1.55* | 1.30* | 1.05* | 1.30* | |
| Toledo, Ohio | 1.50 | 1.25 | 1.25 | 1.25 | 1.25 | 1.25 | 1.25 |
| Youngst'n, O., dist. | 2.00 | 1.25 | 1.35 | 1.35 | 1.25 | 1.25 | 1.25 |
| **SOUTHERN:** | | | | | | | |
| Ashland, Ky. | | 1.45* | | 1.45* | 1.45* | | |
| Easley and Alabama City, Ala. | 2.05 | .80 | 1.35 | 1.25 | .90 | .90 | .80 |
| Longdale, Roanoke, Ruesens, Va. | 2.50 | 1.00 | 1.25 | 1.25 | 1.25 | 1.15 | 1.15 |
| Woodward, Ala. | 2.05* | .80* | 1.35* | 1.25* | .90* | .90* | |

*5c per ton discount on terms.

## Lime Products (Carload Prices Per Ton F.O.B. Shipping Point)

| | Finishing hydrate | Masons' hydrate | Agricultural hydrate | Chemical hydrate | Ground burnt lime, Blk. | Ground burnt lime, Bags | Lump lime, Blk. | Lump lime, Bbl. |
|---|---|---|---|---|---|---|---|---|
| **EASTERN:** | | | | | | | | |
| Berkeley, R. I. | | | 12.00 | | | | | 2.00 |
| Buffalo, N. Y. | | 12.00 | 12.00 | 12.00 | | | 10.00 | 1.95[4] |
| Chazy, N. Y. | | 8.50 | 7.50 | 10.00 | | 15.50[1] | 8.50 | 14.00 |
| Lime Ridge, Penn. | | | | | 5.00[2] | | | |
| Pittsburgh, Penn. | 12.50 | 8.50 | 8.50 | | 9.00 | 11.00 | 8.00 | |
| West Stockbridge, Mass. | 12.00 | 10.00 | 5.60 | | | | | 2.00[12] |
| Williamsport, Penn. | | | 10.00 | | | | 6.00 | |
| York, Penn. | | 9.50 | 9.50 | 10.50 | 8.50 | 10.50 | 8.50 | 1.65[7] |
| **CENTRAL:** | | | | | | | | |
| Afton, Mich. | | | | | | | 8.40 | 1.35 |
| Carey, Ohio | 12.50 | 8.50 | 8.15 | | 9.00 | | 8.00 | 1.50 |
| Cold Springs, Ohio | | 8.50 | 8.50 | | | | 8.00 | |
| Cold Springs and Gibsonburg, Ohio | 12.50 | 8.50 | 8.50 | | 9.00 | 11.00 | | |
| Huntington, Ind. | 12.50 | 8.50 | 8.50 | | 9.00 | | 8.00 | |
| Luckey, Ohio | 12.50 | | | | | | | |
| Milltown, Ind. | | 8.50@10.00 | | 10.00[9] | | | 8.50[22] | 1.35[10] |
| Scioto & Marble Cliff, O. | | 8.50 | 8.50 | 9.50 | 8.25 | .62½ | 7.50 | 1.50[3] |
| Sheboygan, Wis. | 11.50 | | | | | | 9.50 | |
| Wisconsin points[6] | | 11.50 | | | | | 9.50 | |
| Woodville, Ohio | 12.50 | 8.50 | 8.50 | | 9.00 | 11.00[9] | 9.00 | 1.50[3] |
| **SOUTHERN:** | | | | | | | | |
| Allgood, Ala. | 12.50 | 10.00 | | | 8.50 | | 8.50 | 1.50 |
| El Paso, Texas | | | | | | | 7.00 | |
| Frederick, Md. | | 9.00 | 9.00 | 9.50 | 7.50 | 9.00 | 7.50 | 9.00 |
| Graystone, Ala. | 12.50 | 9.00 | | 12.50 | | 1.25[1] | 8.00 | 1.35 |
| Keystone, Ala. | 12.50 | 10.00 | 9.00 | 11.00 | | | 8.00 | 1.50 |
| Knoxville, Tenn. | 20.25 | 9.00 | 9.00 | 9.00 | | | 8.00 | 1.35 |
| New Braunfels, Tex. | 18.00 | 12.00 | 10.00 | 12.00 | 10.00 | | 9.50 | |
| Ocala, Fla. | | 11.50 | 9.00 | | | 1.40[5] | 11.00 | |
| Saginaw, Ala. | 12.50 | 10.00 | 9.00 | 10.00 | | | 8.50 | 1.50 |
| **WESTERN:** | | | | | | | | |
| Cartland, N. M. | | | | | | | 15.00 | |
| Limestone, Wash. | 15.00 | 15.00 | 10.00 | 15.00 | 16.50 | 16.50 | 16.50 | 2.09 |
| Los Angeles, Calif. | 19.00 | 19.00 | 14.00 | | 16.20 | | 12.50 | 2.50 |
| Dittlinger, Tex. | | 12.00@13.00 | | | | | 9.50[8] | 1.50[23] |
| San Francisco, Calif. | 20.00 | 20.00 | 13.50 | 21.00 | | | 14.50[30] | 2.15 |
| Tehachapi, Calif.[13] | 17.00 | 15.00 | 12.00@15.00[11] | 17.00 | 16.00 | | 16.00 | 2.00 |
| Seattle, Wash. | 19.00 | 19.00 | 12.00 | 19.00 | 19.00 | | 18.60 | 2.30 |

[1] Barrels. [2] Net ton. [3] Wooden, steel 1.70. [4] Steel. [5] 180 lb. [6] Dealers' prices, net 30 days less 25c discount per ton on hydrated lime and 5c per bbl. on lump if paid in 10 days. [7] 180-lb. net barrel, 1.65; 280-lb. net barrel, 2.65. [8] To 11.00 [9] 80-lb. [10] To 1.50. [11] Refuse or air slack, 10.00@12.00 [12] To 3.00. [13] Delivered in Southern California. [22] To 9.00. [23] To 1.60. [30] To 16.50.

## Miscellaneous Sands

(Continued)

| City or shipping point | Roofing Sand | Traction |
|---|---|---|
| Estill Springs and Sewanee, Tenn. | 1.35@ 1.50 | 1.35@ 1.50 |
| Franklin, Penn. | | 1.75 |
| Michigan City, Ind. | | .30 |
| Mineral Ridge, Ohio | *1.75 | *1.75 |
| Montoursville, Penn. | | 1.10 |
| Ohlton, Ohio | a1.75@a2.00 | a1.75 |
| Red Wing, Minn. | | 1.00 |
| Round Top, Md. | 2.25 | 1.75 |
| San Francisco, Calif. | 3.50 | 3.50 |
| Thayers, Penn. | | 2.25 |
| Warwick, Ohio | | 2.00 |
| Zanesville, Ohio | | 2.50 |

*Wet. (a) Green.

## Talc

Prices given are per ton f.o.b. (in carload lots only), producing plant, or nearest shipping point.

| | |
|---|---|
| Baltimore, Md.: | |
| Crude talc (mine run) | 3.00@ 4.00 |
| Ground talc (20-50 mesh), bags | 10.00 |
| Cubes | 55.00 |
| Blanks (per lb.) | .08 |
| Pencils and steel worker's crayons | .08 |
| Per gross | 1.00@ 1.50 |
| Chatsworth, Ga.: | |
| Crude talc, grinding | 5.00 |
| Ground talc (150-200 mesh) | 10.00 |
| Pencils and steel worker's crayons, per gross | 1.00@ 2.00 |
| Chester, Vt.: | |
| Ground talc (150-200 mesh), paper bags | 9.50@10.50 |
| Same, burlap bags, bags extra | 8.50@ 9.50 |
| Chicago and Joliet, Ill.: | |
| Ground (150-200 mesh), bags | 30.00 |
| Dalton, Ga.: | |
| Crude talc (for grinding) | 5.00 |
| Ground talc (150-200 mesh), bags | 12.00 |
| Pencils and steel worker's crayons, per gross | 1.00@ 2.50 |
| Emeryville, N. Y.: | |
| (Double air floated) including bags; | |
| 325 mesh | 14.75 |
| 200 mesh | 13.75 |
| Glenden, N. C.: | |
| Crude talc (mine run) | 3.00@ 4.00 |
| Ground talc (150-200 mesh), bags | 8.00@12.00 |
| Hailesboro, N. Y.: | |
| Ground white talc (double and triple air floated) 200-lb. bags, 300-350-mesh | 15.50@20.00 |
| Henry, Va.: | |
| Crude (mine run) | 2.75@ 4.00 |
| Ground talc (150-200 mesh), bags | 9.00@14.50 |
| Joliet, Ill.: | |
| Off color talc, bags | 12.50 |
| California talc, bags | 30.00 |
| Southern talc, bags | 20.00 |
| Pencils and steel worker's crayons, per gross | 2.50 |
| Keeler, Calif.: | |
| Ground (200-300 mesh), bags | 20.00@30.00 |
| Natural Bridge, N. Y.: | |
| Ground talc (125-200 mesh), bags | 10.00@15.00 |

## Rock Phosphate

Prices given are per ton (2240-lb.) f.o.b. producing plant or nearest shipping point.

| | |
|---|---|
| **Lump Rock** | |
| Columbia, Tenn.—B.P.L. 65-70% | 3.50@ 4.50 |
| Gordonsburg, Tenn.—B.P.L. 65-70% | 3.75@ 4.25 |
| Mt. Pleasant, Tenn.—B.P.L. 72.59% | 9.50 |
| Tennessee — F.o.b. mines, gross ton, unground brown rock, B.P.L. 72% | 5.00 |
| B.P.L. 75% | 6.00 |
| Twomey, Tenn.—B.P.L. 65%, 2000 lb. | 8.00@ 9.00 |
| **Ground Rock** (2000 lb.) | |
| Centerville, Tenn.—B.P.L. 65% | 8.00 |
| Gordonsburg, Tenn.—B.P.L. 65-70% | 4.00@ 4.50 |
| Mt. Pleasant, Tenn.—B.P.L. 72% | 5.00@ 5.50 |
| Twomey, Tenn.—B.P.L. 65% | 8.00@ 9.00 |

## Florida Phosphate

**(Raw Land Pebble)**

(Per Ton)

| | |
|---|---|
| Florida — F.o.b mines, gross ton, 68/66% B.P.L., Basis 68% | 3.25 |
| 70% min. B.P.L., Basis 70% | 3.75 |

## Mica

Prices given are net, f.o.b. plant or nearest shipping point.

| | |
|---|---|
| Pringle, S. D.—Mine run, per ton | 125.00 |
| Punch mica, per lb. | .06 |
| Scrap, per ton, carloads | 20.00 |
| Rumney Depot, N. H.—Per ton, | |
| Mine run | 300.00 |
| Clean shop scrap | 25.00 |
| Mine scrap | 22.50@24.00 |
| Roofing mica | 37.50 |
| Punch mica, per lb. | .12 |
| Cut mica—50% from Standard List. | |

## Special Aggregates

Prices are per ton f.o.b. quarry or nearest shipping point.

| City or shipping point | Terrazzo | Stucco-chips |
|---|---|---|
| Barton, Wis., f.o.b. cars | ..... | 10.50 |
| Brandon, Vt. — English pink, English cream and coral pink | *12.50 | *12.50 |
| Brandon grey | *12.50 | *12.50 |
| Brighton, Tenn.— All colors and sizes | §3.00 | §3.00 |
| Buckingham, Que.—Buff stucco dash | ..... | 12.00@14.00 |
| Chicago, Ill. — Stucco chips, in sacks, f.o.b. quarries | ..... | 17.50 |
| Crown Point, N. Y.—Mica spar | ..... | 9.00@10.00 |
| Dayton, Ohio | ..... | 6.00@24.00 |
| Easton, Penn.— Green stucco | ..... | 12.00@18.00 |
| Green granite | ..... | 14.00@20.00 |
| Haddam, Conn.—Felstone buff | 15.00 | 15.00 |
| Harrisonburg, Va.—Bulk marble (crushed, in bags) | †12.50 | †12.50 |
| Ingomar, Ohio—Concrete facings and stucco dash | ..... | 8.00@24.00 |
| Middlebrook, Mo.—Red | ..... | 20.00@25.00 |
| Middlebury, Vt.—Middlebury white | ‡9.00 | ‡9.00 |
| Middlebury and Brandon, Vt.—Caststone, per ton, including bags | ..... | 5.50@ 7.50 |
| Milwaukee, Wis. | ..... | 14.00@34.00 |
| New York, N. Y.—Red and yellow Verona | ..... | 32.00 |
| Phillipsburg, N. J.— Royal green granite | ..... | 12.00@14.00 |
| Randville, Mich.— Crystalite crushed white marble, bulk | 5.00@ 7.50 | 4.50@ 7.50 |
| Rose pink granite, bulk | ..... | 12.00 |
| Stockton, Calif.—"Natrock" roofing grits | ..... | 12.00@18.00 |
| Tuckahoe, N. Y.—Tuckahoe white | 12.00 | ..... |
| Wauwatosa, Wis. | ..... | 20.00@32.00 |
| Wellsville, Colo. — Colorado Travertine Stone | 15.00 | 15.00 |

*Carloads, including bags; L.C.L. 14.50.
†C.L. L.C.L. 17.00.
‡Carloads, including bags; L.C.L. 10.00.
§Bulk, car lots, minimum 30 tons.

## Potash Feldspar

| | |
|---|---|
| Auburn and Topsham, Me. — Color white, 98% thru 140-mesh | 19.00 |
| Bristol, Tenn.—Color, white; analysis, $K_2O$, 6 to 10%; $Na_2O$, 2¼ to 4%; $SiO_2$, 68 to 78%; $Fe_2O_3$, 12 to 20%; $Al_2O_3$, 16.5 to 18.5%; 99% thru 200 mesh; bulk, depending on grade | 14.50@18.00 |
| Brunswick, Me.—Color, white; 98% thru 140 mesh, bulk | 19.00 |
| Buckingham, Ore.—White, analysis, $K_2O$, 12-13%; $Na_2O$, 1.75%; bulk | 9.00 |
| De Kalb Jct., N. Y.—Color, white, bulk (crude) | 9.00 |
| East Hartford, Conn.—Color, white, 95% thru 60 mesh, bags | 16.00 |
| 96% thru 150 mesh, bags | 28.00 |
| East Liverpool, Ohio—Color, white; 98% thru 200 mesh, bulk | 19.35 |
| Soda feldspar, crude, bulk, per ton | 22.00 |
| Glen Tay Station, Ont.—Color, red or pink; analysis, $K_2O$, 12.81%; crude | 7.00 |
| Keystone, S. D.—White; bulk (crude) | 8.00 |
| Los Angeles, Calif.—Color, white; analysis, $K_2O$, 12.16%; $Na_2O$, 1.53%; $SiO_2$, 65.60%; $Fe_2O_3$, .10%; $Al_2O_3$, 10.20%; crude | 10.00 |
| Pulverized, 95% thru 200 mesh; bags, 22.00; bulk | 22.00 |
| Murphysboro, Ill.—Color, prime white; analysis, $K_2O$, 12.60%; $Na_2O$, 2.35%; $SiO_2$, 63%; $Fe_2O_3$, .06%; $Al_2O_3$, 18.20%; 98% thru 200 mesh; bags, 21.00; bulk | 20.00 |
| Penland, N. C.—White; crude, bulk | 8.00 |
| Ground, bulk | 16.50 |
| Spruce Pine, N. C.—Color, white; analysis, $K_2O$, 10%; $Na_2O$, 3%; $Si_2O$, 68%; $Fe_2O_3$, 0.10%; $Al_2O_3$, 18%; 99½% thru 200 mesh | 18.00 |
| Crude | 9.00 |
| Tenn. Mills—Color, white; analysis $K_2O$, 18%; $Na_2O_3$, 10%; 68% $SiO_2$; 99% thru 200 mesh; bulk | 18.00 |
| 99% thru 140 mesh, bulk | 16.00 |
| Toronto, Can.—Color, flesh; analysis $K_2O$, 12.75%; $Na_2O$, 1.96%; crude | 7.50@ 8.00 |

## Chicken Grits

| | |
|---|---|
| Afton, Mich. (Limestone), per ton | 1.75 |
| Belfast and Rockland, Me.—(Limestone), bags, per ton | 10.00 |
| Cartersville, Ga.—(Limestone), per bag | 2.00 |
| Centerville, Iowa—(Gypsum), per ton | 18.00 |
| Chico and Bridgeport, Tex.—Hen | ¶9.00 |
| Baby chick, per ton | ¶8.00 |
| Danbury, Conn.—(Limestone), bulk | 6.00@ 7.00 |
| Easton, Penn.—Per ton, bulk | 3.00 |
| Joliet, Ill.—(Limestone), bags, per ton | 4.50 |
| Knoxville, Tenn.—Per bag | 1.25 |
| Los Angeles, Calif.—(Feldspar), per ton | 15.00 |
| Gypsum, Ohio—(Gypsum), per ton | 10.00 |
| Hartford, Conn. | ‡7.50@*9.00 |
| Limestone, Wash. — (Limestone), per ton | 12.50 |
| Marion, Va.—(Limestone), bulk, 5.00; bagged, 6.50; 100-lb. bag | .50 |
| Middlebury, Vt.—Per ton | 10.00 |
| Rocky Point, Va.—(Limestone), 100-lb. bags, 50c; sacks, per ton, 6.00; bulk | 5.00 |
| Seattle, Wash.—(Limestone), bulk, per ton | 10.00 |
| Warren, N. H.—(Mica), per ton | 3.85@ 3.90 |
| Waukesha, Wis.—(Limestone), per ton | 8.00 |
| West Stockbridge, Mass.—(Limestone), bulk | ‡7.50@*9.00 |
| Wisconsin Points—(Limestone), per ton | 9.00 |

*L.C.L. †Less than 5-ton lots. ‡C.L. ¶100-lb. bags.

## Sand-Lime Brick

Prices given per 1000 brick f.o.b. plant or nearest shipping point, unless otherwise noted.

| | |
|---|---|
| Albany, Ga. | 12.00 |
| Anaheim, Calif. | 10.50@11.00 |
| Barton, Wis. | 10.50 |
| Boston, Mass. | 17.00* |
| Brighton, N. Y. | 19.75* |
| Brownstone, Penn. | 11.00 |
| Dayton, Ohio | 12.50@13.50 |
| Detroit, Mich. | 16.00* |
| Farmington, Conn. | 13.00 |
| Flint, Mich. | ¶12.00@17.50* |
| Grand Rapids, Mich. | 12.50 |
| Hartford, Conn. | 14.00@19.00* |
| Jackson, Mich. | 12.25 |
| Lakeland, Fla. | 10.00@11.00 |
| Lake Helen, Fla. | 9.00@12.00 |
| Lancaster, N. Y. | 12.25 |
| Madison, Wis. | 12.50a |
| Michigan City, Ind. | 11.00 |
| Milwaukee, Wis. | 13.00* |
| Minneapolis and St. Paul, Minn. | 10.00 |
| Minnesota Transfer | 10.00 |
| New Brighton, Minn. | 10.00 |
| Pontiac, Mich. | 16.00@17.00 |
| Portage, Wis. | 16.00 |
| Prairie du Chien, Wis. | 18.00@22.50 |
| Rochester, N. Y. | 19.75* |
| Saginaw, Mich. | 13.50 |
| San Antonio, Texas | 16.00 |
| Sebewaing, Mich. | 12.00 |
| Sioux Falls, S. Dak. | 13.00 |
| South River, N. J. | 13.00 |
| Syracuse, N. Y. | 18.00@20.00 |
| Toronto, Canada | 16.00*† |
| Wilkinson, Fla. | 12.00@16.00 |
| Winnipeg, Canada | 14.00 |

*Delivered on job. †5% disc., 10 days. ¶Dealers' price. (a) Less 50c discount per M., 10 days.

## Portland Cement

Prices per bag and per bbl., without bags, net in carload lots.

| | Per Bag | Per Bbl. |
|---|---|---|
| Albuquerque, N. M. | .84¼ | 3.37 |
| Atlanta, Ga. | ..... | 2.35 |
| Baltimore, Md. | ..... | 2.15@2.25 |
| Birmingham, Ala. | ..... | 2.30 |
| Boston, Mass. | ..... | 2.13@2.23 |
| Buffalo, N. Y. | ..... | 2.20@2.30 |
| Butte, Mont. | .90¼ | 3.61 |
| Cedar Rapids, Iowa | ..... | 2.24 |
| Charleston, S. C. | ..... | 2.35 |
| Cheyenne, Wyo. | .82¾ | 3.31 |
| Cincinnati, Ohio | .58 | 2.32 |
| Cleveland, Ohio | ..... | 2.24 |
| Chicago, Ill. | .51¼ | 2.05 |
| Columbus, Ohio | .57¼ | 2.29 |
| Concrete, Wash. | ..... | 2.35 |
| Dallas, Texas | ..... | 2.00 |
| Davenport, Calif. | ..... | 2.45* |
| Davenport, Iowa | ..... | 2.24 |
| Dayton, Ohio | .58¼ | 2.33 |
| Denver, Colo. | .66¼ | 2.65 |
| Des Moines, Iowa | ..... | 2.05 |
| Detroit, Mich. | ..... | 2.00 |
| Duluth, Minn. | ..... | 2.04 |
| Houston, Texas | ..... | 2.00 |
| Indianapolis, Ind. | .54¾ | 2.19 |
| Jackson, Miss. | ..... | 2.30 |
| Jacksonville, Fla. | ..... | 2.20 |
| Jersey City, N. J. | ..... | 2.03@2.13 |
| Kansas City, Mo. | ..... | 1.92 |
| Los Angeles, Calif. | .57½ | 2.50 |
| Louisville, Ky. | .55½ | 2.22 |
| Memphis, Tenn. | ..... | 2.30 |
| Milwaukee, Wis. | ..... | 2.00@2.20 |
| Minneapolis, Minn. | ..... | 2.12@2.22 |
| Montreal, Que. | ..... | 1.36 |
| New Orleans, La. | ..... | 2.20 |
| New York, N. Y. | ..... | 1.93@2.03 |
| Norfolk, Va. | ..... | 2.07 |
| Oklahoma City, Okla. | ..... | 2.46 |
| Omaha, Neb. | ..... | 2.36 |
| Peoria, Ill. | ..... | 2.22 |
| Philadelphia, Penn. | ..... | 2.11@2.21 |
| Phoenix, Ariz. | .76½ | 3.06 |
| Pittsburgh, Penn. | ..... | 2.04 |
| Portland, Colo. | ..... | 2.80 |
| Portland, Ore. | ..... | 2.60 |
| Reno, Nev. | ..... | 2.91 |
| Richmond, Va. | ..... | 2.24@2.34 |
| Salt Lake City, Utah | .70¼ | 2.81 |
| San Francisco, Calif. | ..... | 2.21 |
| Savannah, Ga. | ..... | 2.50 |
| St. Louis, Mo. | .51¼ | 2.05 |
| St. Paul, Minn. | ..... | 2.12@2.22 |
| Seattle, Wash. | ..... | 2.50† |
| Tampa, Fla. | ..... | 2.25 |
| Toledo, Ohio | ..... | 2.20 |
| Topeka, Kan. | ..... | 2.41 |
| Tulsa, Okla. | ..... | 2.33 |
| Wheeling, W. Va. | ..... | 2.12 |
| Winston-Salem, N. C. | ..... | 2.59 |

NOTE—Add 40c per bbl. for bags.
*Includes sacks.
†10% discount, 10 days.

Mill prices f.o.b. in carload lots, without bags, to contractors.

| | Per Bag | Per Bbl. |
|---|---|---|
| Albany, N. Y. | .43¾ | 1.75 |
| Buffington, Ind. | ..... | 1.80 |
| Chattanooga, Tenn. | ..... | 2.45* |
| Concrete, Wash. | ..... | 2.35 |
| Davenport, Calif. | ..... | 2.35 |
| Detroit, Mich. | ..... | 2.15 |
| Hannibal, Mo. | ..... | 1.90 |
| Hudson, N. Y. | ..... | 1.75 |
| Leeds, Ala. | ..... | 1.65 |
| Mildred, Kan. | ..... | 2.35 |
| Nazareth, Penn. | ..... | 2.15 |
| Northampton, Penn. | ..... | 1.75 |
| Richard City, Tenn. | ..... | 2.05 |
| Steelton, Minn. | ..... | 1.85 |
| Toledo, Ohio | ..... | 2.20 |
| Universal, Penn. | ..... | 1.80 |

*Including sacks at 10c each.

## Gypsum Products—CARLOAD PRICES PER TON AND PER M SQUARE FEET, F.O.B. MILL

| | Crushed Rock | Ground Gypsum | Agricultural Gypsum | Stucco Calcined Gypsum | Cement and Gauging Plaster | Wood Fiber | Gauging White | Plaster Sanded | Cement Keene's | Finish Trowel | —Plaster Board— ¼x32x 36". Per M Sq. Ft. | ¾x32x 36". Per M Sq. Ft. | Wallboard, ¾x32 or 48". Lengths 6'-10'. Per M Sq. Ft. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Arden, Nev., and Los Angeles, Calif. | 3.00 | 8.00u | 8.00u | 10.70u | 10.70u | ..... | ..... | ..... | ..... | 11.70u | ..... | ..... | ..... |
| Centerville, Iowa | 3.00 | 10.00 | 15.00 | 10.00 | 10.00 | 10.50 | 13.50 | ..... | ..... | 13.50 | ..... | ..... | ..... |
| Des Moines, Iowa | 3.00 | 8.00 | 9.00 | 10.00 | 10.00 | 10.50 | 13.50 | 12.00 | 24.00 | 22.00 | 18.00 | 21.00 | 30.00 |
| Detroit, Mich. | ..... | ..... | ..... | ..... | 14.30o | 12.30 m | ..... | m9.00@11.00o | ..... | ..... | ..... | ..... | ..... |
| Delawanna, N. J. | ..... | ..... | ..... | ..... | ..... | 8.00 | ..... | 9.00 | ..... | ..... | .14½ | .15½ | 30.00 |
| Douglas, Ariz. | ..... | ..... | 6.00 | ..... | ..... | ..... | 15.00 | ..... | 40.00 | 13.50 | 35.00 | 45.00 | ..... |
| Grand Rapids, Mich. | 2.75 | 6.00 | 6.00 | 8.00 | 9.00 | 9.00 | 17.50 | ..... | 24.55 | 20.00 | ..... | ..... | ..... |
| Gypsum, Ohio | 3.00 | 4.00 | 6.00 | 8.00 | 9.00 | 9.00 | 19.00 | 7.00 | 27.50 | 19.00 | ..... | 15.00 | 30.00 |
| Los Angeles, Calif. | ..... | ..... | 7.50@9.50 | 11.50y | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Port Clinton, Ohio | 3.00 | 4.00 | 6.00 | 10.00 | 9.00 | 9.00 | 21.00 | 7.00 | 30.15 | 20.00 | ..... | 20.00 | 30.00 |
| Portland, Colo. | ..... | ..... | ..... | 10.00 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| San Francisco, Calif. | ..... | ..... | 11.65m | 13.40r | 14.40r | ..... | 15.40r | ..... | ..... | ..... | ..... | ..... | ..... |
| Seattle, Wash. | 6.00 | 10.00 | 10.00 | 13.00 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Sigurd, Utah | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 21.50 | ..... | ..... | ..... | ..... |
| Winnipeg, Man. | 5.00 | 5.00 | 7.00 | 13.00 | 14.00 | 14.00 | ..... | ..... | ..... | ..... | 20.00 | 25.00 | 33.00 |

NOTE—Returnable bags, 10c each; paper bags, 1.00 per ton extra (not returnable).
(m) Includes paper bags; (o) includes jute sacks; (r) including sacks at 15c; (u) includes sacks; (y) sacks 15c extra, rebated.

# Market Prices of Cement Products

## Concrete Block

Prices given are net per unit, f.o.b. plant or nearest shipping point

| City or shipping point | Sizes 8x8x16 | 8x10x16 | 8x12x16 |
|---|---|---|---|
| Camden, N. J. | 17.00 | ..... | ..... |
| Cement City, Mich. | | 5x8x12—55.00¶ | |
| Columbus, Ohio | 17.00c@19.00a | ..... | ..... |
| Detroit, Mich. | .16 | ..... | .18 |
| Forest Park, Ill. | 21.00* | ..... | ..... |
| Grand Rapids, Mich. | 15.00@16.00a | ..... | ..... |
| Graettinger, Iowa | .18@ .20 | ..... | ..... |
| Indianapolis, Ind | .13@ .15† | ..... | ..... |
| Los Angeles, Calif.¶ | 5¾x3½x12—55.00 | 7¾x3½x12—65.00 | |
| Oak Park, Ill. | 20.00 | ..... | ..... |
| Olivia and Mankato, Minn. | 9.50b | ..... | ..... |
| Somerset, Penn. | .20@ .25 | ..... | ..... |
| Tiskilwa, Ill. | .16@ .18† | ..... | ..... |
| Yakima, Wash. | 20.00* | ..... | ..... |

*Price per 100 at plant. †Rock or panel face. (a) Face. ‡Delivered. ¶Price per 1000. (b) Per ton. (c) Plain.

## Cement Roofing Tile

Prices are net per sq. in. carload lots, f.o.b. nearest shipping point, unless otherwise stated.

Camden and Trenton, N. J.—8x12, per sq.

| | |
|---|---|
| Red | 15.00 |
| Green | 18.00 |
| Chicago, Ill.—Per sq. | 20.00 |

Cicero, Ill.—Hawthorne roofing tile, per sq.

| | Chocolate, Red, Yellow, Gray, and Orange | Green, Blue |
|---|---|---|
| French and Spanish† | $11.50 | $13.50 |
| Ridges (each) | .25 | .35 |
| Hips | .25 | .35 |
| Hip starters | .50 | .60 |
| Hip terminals, 2-way | 1.25 | 1.50 |
| Hip terminals, 4-way | 4.00 | 5.00 |
| Mansard terminals | 2.50 | 3.00 |
| Gable finials | 1.25 | 1.50 |
| Gable starters | .25 | .35 |
| Gable finishers | .25 | .35 |
| *End bands | .25 | .35 |
| *Eave closers | .06 | .08 |
| *Ridge closers | .05 | .06 |

*Used only with Spanish tile.
†Price per square.

| | |
|---|---|
| Houston, Texas—Roofing Tile, per sq. | 25.00 |
| Indianapolis, Ind.—9x15-in. | Per sq. |
| Gray | 10.00 |
| Red | 11.00 |
| Green | 13.00 |
| Waco, Texas: | Per sq. |
| 4x4 | .60 |

## Cement Building Tile

| | |
|---|---|
| Cement City, Mich.: | Per 100 |
| 5x8x12 | 5.00 |
| Grand Rapids, Mich.: | |
| 5x8x12 | 8.00 |
| 5x4x12 | 4.50 |
| Longview, Wash.: | Per 1000 |
| (Stone-Tile) | |
| 4x6x12 | 55.00 |
| 4x8x12 | 64.00 |
| Mt. Pleasant, N. Y.: | Per 1000 |
| 5x8x12 | 78.00 |
| Grand Rapids, Mich.: | Per 100 |
| 5x8x12 | 7.00 |
| Houston, Texas: | |
| 5x8x12 (Lightweight) | 80.00 |
| Pasadena, Calif. (Stone Tile): | Per 100 |
| 3½x4x12 | 3.00 |
| 3½x6x12 | 4.00 |
| 3½x8x12 | 5.50 |
| Tiskilwa, Ill.: | Per 100 |
| 8x8 | 15.00 |
| Wildasin Spur, Los Angeles, Calif. (Stone-Tile): | Per 1000 |
| 3½x6x12 | 50.00 |
| 3½x8x12 | 60.00 |
| Prairie du Chien, Wis.: | |
| 5x8x12 | 82.00 |
| 5x4x12 | 46.00 |
| 5x8x 6 (half-tile) | 41.00 |
| 5x8x10 (fractional) | 82.00 |
| Yakima, Wash. (Building Tile): | |
| 5x8x12 | .10 |

## Cement Drain Tile

| | |
|---|---|
| Graettinger, Iowa—5 to 36 in., per ton | 8.00 |
| Olivia and Mankato, Minn.—Cement drain tile, per ton | 8.00 |
| Tacoma, Wash.—Drain tile, per ft.: | |
| 3 in. | .04 |
| 4 in. | .05½ |
| 6 in. | .07½ |
| 8 in. | .10 |
| Waukesha, Wis.—Drain tile, per ton | 8.00 |

## Concrete Brick

Prices given per 1000 brick, f.o.b. plant or nearest shipping point.

| | Common | Face |
|---|---|---|
| Appleton, Minn. | 22.00 | 25.00@40.00 |
| Baltimore, Md. (Del. according to quantity) | 15.50 | 22.00@50.00 |
| Camden and Trenton, N. J. | 17.00 | ..... |
| Ensley, Ala. ("Slagtex") | 14.50 | 22.50@33.50 |
| Eugene, Ore. | 25.00 | 35.00@75.00 |
| Forest Park, Ill. | ..... | 37.00 |
| Friesland, Wis. | 22.00 | 32.00 |
| Longview, Wash.* | 15.00 | 22.50@65.00 |
| Milwaukee, Wis. | 14.00 | 18.00@50.00 |
| Mt. Pleasant, N. Y. | ..... | 14.00@23.00 |
| Oak Park, Ill. | ..... | 42.00 |
| Omaha, Neb. | 18.00 | 30.00@ 40.00 |
| Pasadena, Calif. | 10.00 | ..... |
| Philadelphia, Penn. | 14.75 | 20.00 |
| Portland, Ore. | 17.50 | 23.00@55.00 |
| Mantel brick—100.00@150.00 | | |
| Prairie du Chien, Wis. | 14.00 | 22.50@ 25.00 |
| Rapid City, S. D. | 18.00 | 25.00@40.00 |
| Waco, Texas | 16.50 | 32.50@125.00 |
| Watertown, N. Y. | 20.00 | 35.00 |
| Westmoreland Wharves, Penn. | 14.75 | 20.00 |
| Winnipeg, Man. | 14.00 | 22.00 |
| Yakima, Wash. | 22.50 | ..... |

*40% off List.

## Current Prices Cement Pipe

Prices are net per foot f.o.b. cities or nearest shipping point in carload lots unless otherwise noted.

| Culvert and Sewer | 4 in. | 6 in. | 8 in. | 10 in. | 12 in. | 15 in. | 18 in. | 20 in. | 22 in. | 24 in. | 27 in. | 30 in. | 36 in. | 42 in. | 48 in. | 54 in. | 60 in. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Detroit, Mich. | | | | | | | | 15.00 per ton | | | | | | | | | |
| Graettinger, Iowa | .04½d | .05½ | .08½ | .12½ | .17½ | ..... | .40 | .50 | .60 | .70 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Grand Rapids, Mich. (b) | | | | | | | | | | | | | | | | | |
| Culvert pipe | ..... | ..... | ..... | .60 | .72 | 1.00 | 1.28 | 1.60† | ..... | 1.92 | 2.32 | 3.00 | 4.00 | 5.00 | 6.00 | ..... | ..... |
| Sewer pipe (d) | ..... | ..... | ..... | ..... | ..... | .63 | ..... | .60† | ..... | ..... | ..... | .58 | ..... | ..... | ..... | ..... | ..... |
| Houston, Texas | ..... | .19 | .28 | .43 | .55½ | .90 | 1.30 | ..... | 1.70† | 2.20 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Indianapolis, Ind. (a) | ..... | ..... | ..... | .80 | .90 | 1.10 | 1.30 | ..... | ..... | 1.70 | ..... | 2.70 | ..... | ..... | ..... | ..... | ..... |
| Longview, Wash. | | | | | | | | Sewer pipe 40% off list; culvert—list | | | | | | | | | |
| Mankato, Minn. (b) | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 1.50 | 1.75 | 2.50 | 3.25 | 4.25 | ..... | ..... | ..... |
| Newark, N. J. | | | | | | | | 6 in. to 24 in., $18.00 per ton | | | | | | | | | |
| Norfolk, Neb. (b) | ..... | ..... | ..... | .90 | 1.00 | 1.13 | 1.42 | ..... | ..... | 2.11 | ..... | 2.75 | 3.58 | ..... | 6.14 | ..... | 7.78 |
| Olivia, Mankato, Minn. | | | | | | | | 12.00 per ton | | | | | | | | | |
| Paullina, Iowa‡ | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 2.25 | ..... | 2.11 | ..... | 2.75 | 3.58 | ..... | 6.14 | ..... | 7.78 |
| Somerset, Penn. | ..... | ..... | ..... | ..... | 1.08 | 1.25 | 1.65 | ..... | ..... | 2.50 | ..... | 3.65 | 4.85 | 7.50 | 8.50 | ..... | ..... |
| Tiskilwa, Ill. (rein.) (a) | ..... | ..... | ..... | .65 | .75 | .85 | .75 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Wahoo, Neb. (b) | ..... | ..... | ..... | ..... | 1.00 | 1.13 | 1.10 | 1.60 | ..... | 1.90 | ..... | 2.25 | 3.40 | ..... | 5.50 | ..... | ..... |
| Yakima, Wash. | | | | | | | 1.42 | ..... | ..... | 2.11 | ..... | 2.75 | 3.58 | 4.62 | 6.14 | 6.96 | 7.78 |
| Tacoma, Wash. | .15 | .18 | .25 | .38 | .45 | .60 | | $10.00 per ton | | | | | | | | | |

(a) 24-in. lengths; (b) Reinforced; (d) Eastern clay, list, 72% and 60% off.
†21-in. diam. ‡Price per 2-ft. length.

## Market Comment

WITH few exceptions the reports of producers of rock products show very little fluctuation in prices from the preceding reports. There are no appreciable difference for crushed stone of any kind, including agricultural limestone. Sand and gravel prices remain the same, except for a slight upward trend reported from some plants in Wisconsin and Minnesota. There are no changes in silica sand, nor in sand-lime brick, gypsum, lime products and cement products. Two or three plants report a slight raise in slag prices in the East. Portland cement shows no change.

## Prices for Municipal Crushed Stone in Washington State

THE South Bend, Wash., municipal rock crusher will resume operation for a few days as soon as the weather permits, according to the authorization granted at the meeting of the city council recently.

The act is made necessary by private orders for crushed rock, aggregating more than 100 yd., and the probability that an improvement district will be organized.

With the reopening of the quarry and crusher, rock will be available for any persons who place their orders with the city treasurer at once, the price to be $2.25 per yd. delivered for coarse rock and $2.75 for fines.—*South Bend* (Wash.) *Journal.*

## New Kind of Gypsum Tile

A NEW kind of hollow tile, known as structolite tile, designed for the erection of exterior walls and bearing partitions in residences, garages and other light occupancy buildings, has just been announced by the United States Gypsum Co., Chicago.

Structolite tile are kiln dried and are manufactured from structolite cement, which is extensively used in poured masonry construction. The advantages claimed are that the tile can be nailed, sawed and fitted with ease of soft wood, that they effectively retard the passage of sound as well as heat, and that they are incombustible.

They are designed to withstand 1000 lb. per square inch gross area, and can be obtained in standard 8x8x16-in. and 8x6x16-in. and also 8x12x16-in. and 6x12x16-in. sizes.

# Cement Products

TRADE MARK REGISTERED WITH U S PATENT OFFICE

## Some of the Formulas for a Successful Cement Products Business

### Enterprise in Selling—Right Materials and Mix—Economy in Labor of Manufacture and Handling

THIS department of ROCK PRODUCTS is published to give producers of crushed stone, sand, gravel and slag some idea of the growth and development of the cement products industry, not merely as an outlet for their materials, but as a possible side line, or byproducts business for them to engage in. Readers who have followed this department must realize that the cement products business is gradually but surely passing out of the hands of backyard, day-labor producers, who get their sand with wheel-barrows from some questionable source, to building supply dealers, who buy commercial aggregates, or to products manufacturers who operate adjacent to, and frequently as subsidiary to, bona fide commercial aggregate producers.

A considerable number of the newest and most efficient cement products plants have been established by city building supply dealers, for reasons that are typical of the changing character of the industry—the ability to purchase cement and clean, graded aggregates to good advantage; sufficient intelligent supervision to see that these aggregates are combined to make a quality product; enterprise in sales effort.

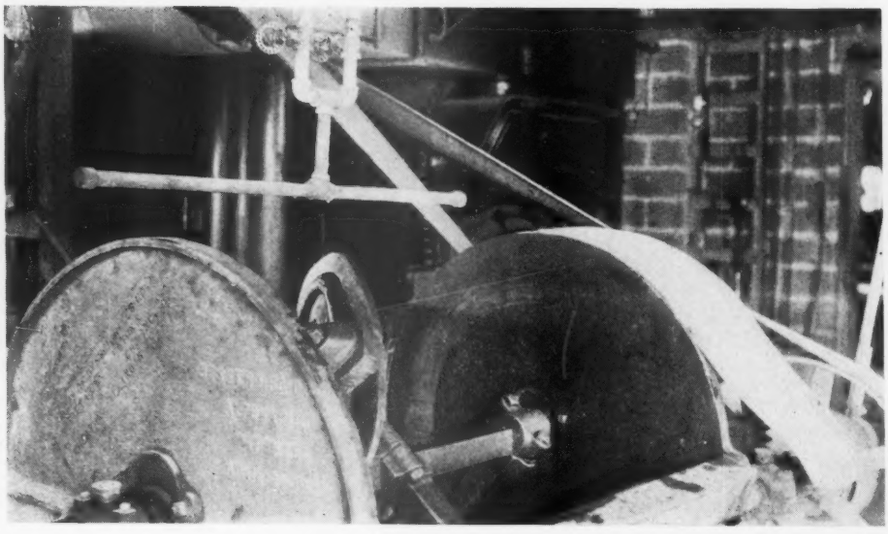
The sand, gravel, crushed stone and slag producer has a vital interest in these developments because a type of cement products producer has come into the industry who appreciates quality, commercial aggregates, and because the example of business success that such producers offer can well be emulated by aggregate producers, who

*Cranes handling material to hoppers at the products plant*

*Stock piles of finished block in the yard*

*Special catch basin blocks and rings*

*Main building of products plant . Kilns to the right*

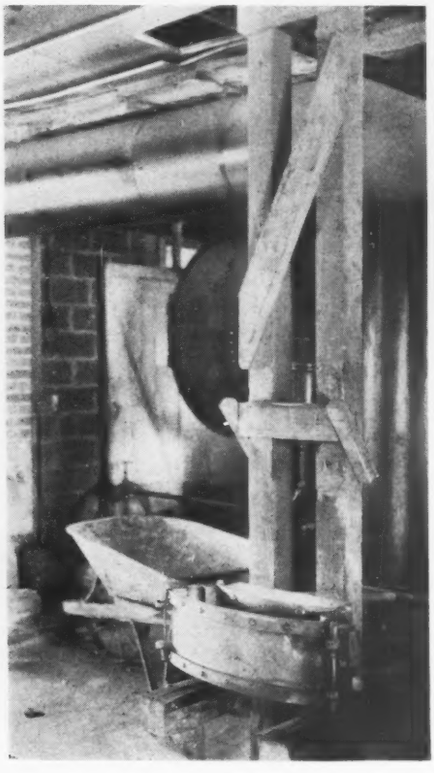


***The mix for catch basin block and specialties is prepared in this 1-yd. concrete mixer***

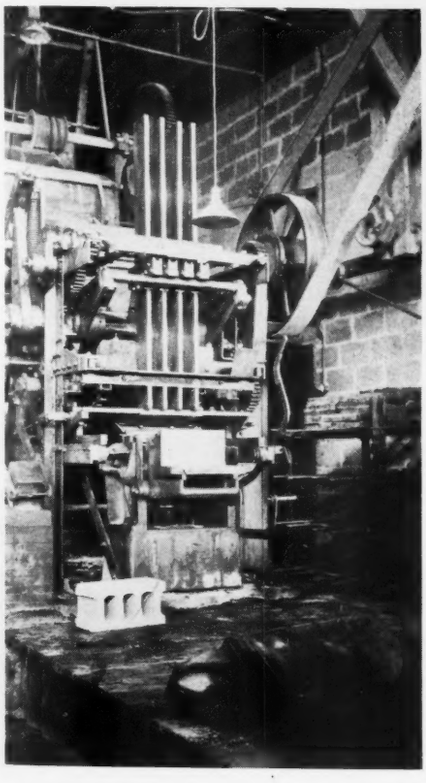
have or should have all the requisites for making a similar success.

### *Wheaton Plant*

The block plant of F. E. Wheaton and Co., in Wheaton, Ill., one of Chicago's western suburbs, is a good example of such a cement products business as we have referred to. It was established about a year and a half ago as a side line for a lumber and building supply business, which the company was carrying on very successfully. The decision to install the block plant was reached when the demand for block became much too heavy to be filled by a small hand machine, then in use at the yard. The commercial block which the Wheaton company could obtain from nearby producers to fill their orders did not meet the exacting requirements which the company wished its block to have. That the decision was a sound one was shown by the immediate success of the new venture, a success which was in no small measure aided by the progressiveness and aggressiveness of the organization back of the plant. From a small adjunct of the main supply yard the cement block plant has grown into one of the big features of the yard.



***Form for construction of catch basin block***

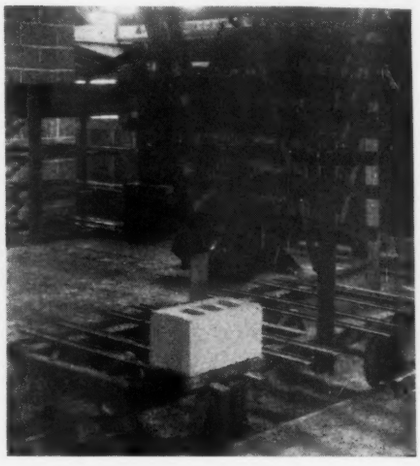


***Automatic stripper and drive***

The building housing the block machinery is very nearly in the center of the big yard, and is built, naturally, of block. It is divided into three parts, one of which, higher than the others, contains the main block machine, the second part holds the boiler and a supplementary mixer, while the third part is the low kiln building. On one side of the plant is a spur track from the Chicago and Northwestern railroad, while on the other side is a yard for storing the block.

### *Plant and Equipment*

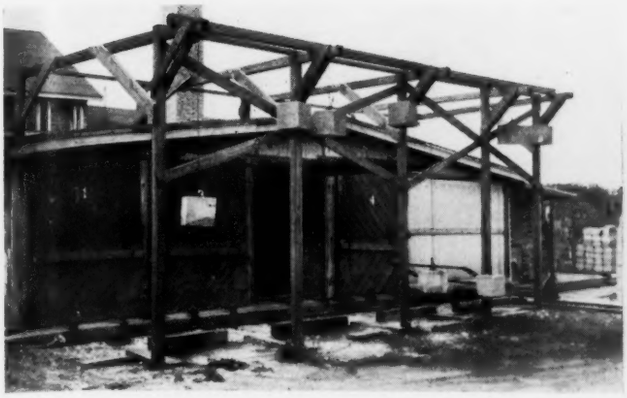
Two Brownhoist cranes with caterpillar treads are used to unload the sand and stone screenings from the cars. One crane has a ½-yd. bucket, and the other has a ¾-yd. bucket. These cranes are used to move all the material for the general yard, as well as the material for the block plant.



***Kiln car with hinged racks and spring suspension***

The main unit of the plant is the 14-cu. ft. mixer and the block machine made by the Besser Manufacturing Co., powered by a 25-hp. Westinghouse electric motor. The Wheaton company uses the dry tamping process, which is probably the most economical method to obtain the product which they turn out. The material for the mixer is stored in two bins to the rear of the machines, and the mixer loader is filled from them by one man who has complete charge of getting the right mix in the machine. The bins hold about 35 yd. and 75 yd. respectively, the smaller containing crushed stone screenings and the larger holding sand.

The company uses a mix of 2½ bags of cement to 10 cu. ft. of sand and 2 cu. ft. of limestone screenings. The foreman of the plant, William Bauler, says that "crushed stone is the only thing" for cement block, meaning, of course, if it is used with enough sand. A block made entirely with crushed stone for an aggregate, he says, is too pasty and does not have a good appearance, but, on the other hand, a block made from sand and gravel exclusively has not the strength of a block containing both screenings and sand, at least when it is first made. The limestone used at the plant comes from the Elmhurst-Chicago Stone Co., at Elmhurst, Ill., which is only eight or nine miles from Wheaton (where, incidentally, blocks are made using



*Outside of kilns. Note arrangements of doors and counterweights*

*Inner end of steam rooms showing trackage details and curtains to close off the rooms*

limestone screenings for aggregate exclusively).

The Besser machine turns out block at the rate of more than three a minute, which means the daily output of the plant runs around 1500 block. Moreover, the whole layout only requires four men for capacity operation. The block come from the machine containing just enough water so that they will stand when the form is removed without any appreciable slump. The cars used in the steam rooms are made by the Besser company, and are the convenient hinged-rack spring-suspended type. With a full load of 80 block the car is sent immediately to the steam rooms.

### *Curing Kilns*

There are four single-track kilns and one of double-track. Each kiln track is reached from the track beside the block machine by use of a transport car moving on a track across the ends of the kilns. As the loaded car enters the steam room it is recorded on a convenient blackboard with such information as the date, time of entry, number of block and type of block. Each car remains in the steam for 24 hours. The kilns are supplied with live steam from pipes along the floor.

An interesting kink in the layout of the steam room tracks is the way they have been graded. As a load enters at the mixer end of the kiln the grade slopes downward so that the car is carried slowly by gravity to the far end of the kiln. But 10 ft. from the other end the grade turns sharply upward, so that the car is stopped and there is no danger of its crashing into the outer door at the far end. This upward grade also prevents a car from rolling out without control when the outer door is thrown open.

Steam for the kilns is supplied from a Kewanee boiler in the smaller room of the building which also houses the supplementary mixer. The boiler is used to heat the office, lumber sheds, saw mill, and other buildings of the yard, as well as supplying steam for the kilns. The heated water from the steam rooms is pumped back to the boiler and reused.

While plain cement block are the chief product of the plant, the company also makes quite a specialty of a catch-basin block. These blocks are a particular development of H. C. Shields, the engineer who designed the plant for the Wheaton company. The materials for these blocks are mixed in the smaller mixer, a 9-cu. ft. Besser machine. This mixer, however, is not generally used to full capacity for a batch. In mixing, the materials are given three minutes dry mix in the machine, followed by three minutes of wet mix. The blocks are molded by hand in the special form developed by Mr. Shields, which has now been mounted on two upright 4x4 in. pieces at an easy working height above the floor. A small pallette table is firmly attached below the form so that the assembly provides ease and speed for the work. The block can be turned out at the rate of 15 per hour by one man.

*Interior of one of the five curing rooms*

While the development of catch basin block business is by no means unusual, this type of cement product has not been used extensively in the Middle West, nor in the East. The ease and strength with which catch basins can be built with such block should recommend their use to engineers and contractors everywhere. It appears that if this type of block were well enough known, the demand would certainly increase greatly simply because of the merits of the block itself. Their manufacture would not require extensive additional machinery in any products plant. Moreover, the block do not have to have an attractive and finished appearance, since they are nowhere exposed to view. What is required is strength, waterproofness and durability. It should not be hard for any careful and intelligent products manufacturer to obtain these qualities.

The Wheaton company also makes the concrete rings for catch basin tops. This work is easily done on the concrete floor of the plant. Two steel rings are used for forms. The inner ring is exactly centered in the outer one when the cement is placed in the form, by the use of four small wood blocks of equal length placed between the two rings. The catch basin block—both rings and side blocks—are sold almost exclusively for municipal work.

### *Manufacturing Efficiency*

An interesting idea for plant economy for small plants is used by the company in its handling of tools. A checking system has been established so that the foreman, who has charge of the tool room, has a record of each tool taken out by any employe. No elaborate system is used nor needed. A printed slip is filled out with the workman's name and the tool obtained, but this simple method has done much to prevent the mislaying of many tools.

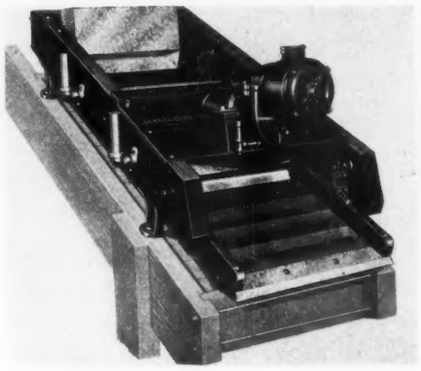
The products of the block plant are distributed by trucks owned by the Wheaton company. A fleet of 14 trucks is operated by the company for their general yard and for the block plant. Ralph L. Wheaton is president of the company and Henry W. Wheaton is treasurer.

# New Machinery and Equipment

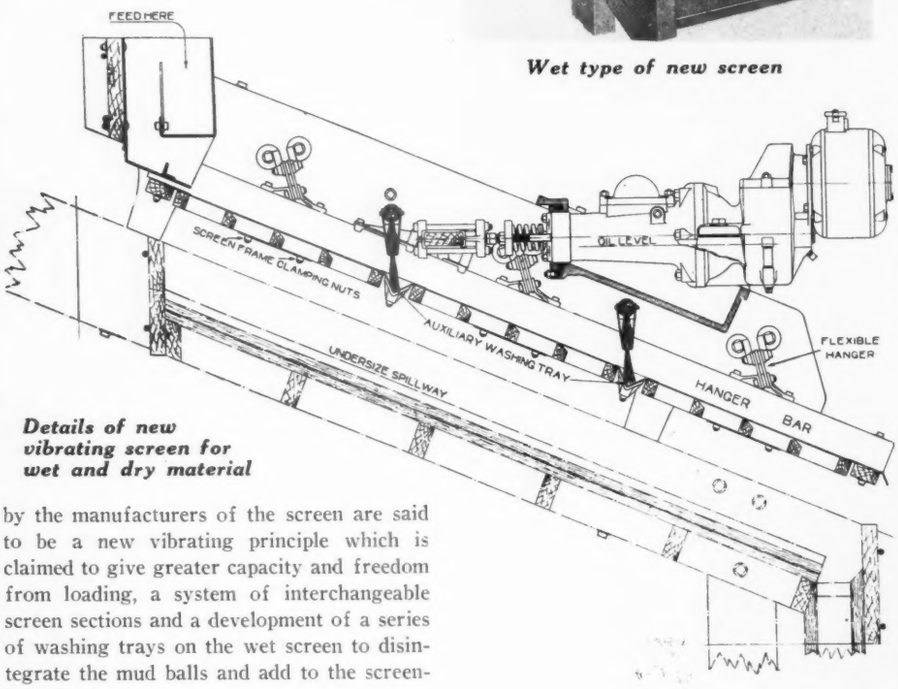
## New Vibrating Screen

THE Norwood Engineering Co., Florence, Mass., has acquired the sales rights to the recently developed James vibrating screen. This screen, said to be successful in meeting the screening and sizing requirements of metal mining, is claimed to offer advantages in performing similar work in sand and gravel, crushed stone and other rock products.

Chief among the advancements featured by the manufacturers of the screen are said to be a new vibrating principle which is claimed to give greater capacity and freedom from loading, a system of interchangeable screen sections and a development of a series of washing trays on the wet screen to disintegrate the mud balls and add to the screening efficiency.

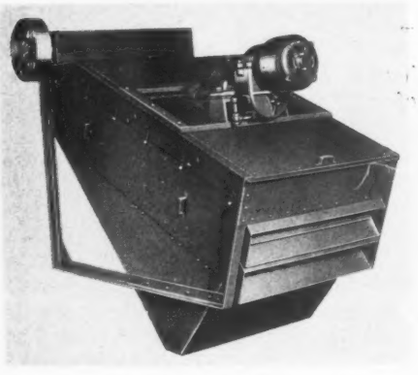


*Wet type of new screen*




***Details of new vibrating screen for wet and dry material***

The present vibrator consists of three moving parts; a gyrating ram weighing over 30 lb. operates against a heavy piston, which in turn transmits the shock through a small anvil to a wooden cross member connecting the hanger bars which carry the screen frame. This ram gyrates at 300 r.p.m. and each of its six steel sockets collide with the hardened steel contact points of the piston, giving to the latter member 1800 bumps per minute. These repeated shocks transmitted to the screen are said to keep the screen from blinding and give uniformity in vibration over its entire surface.



***Dry type with housing to minimize dusting***

The vibrator is housed in a tight cast iron casing and requires a change of oil but once every few months, it is said. The screen frame is suspended by flexible vanadium steel hangers. The frames are built in sections, which are interchangeable; every 6 sq. ft. of screening surface may be removed and replaced under actual working conditions in a short time, the makers say.

When screening materials by the wet process finer than 3/16 in. in diameter, auxiliary washing trays located every two feet across the screen area, serve to disintegrate the accumulation of mud balls and by the addition of a sufficient amount of wash water, the fine grains are forced through the meshes with great rapidity, according to the manufacturers. This feature is said to be entirely new and add considerably to screening efficiency.

The James screen operates with a one-horse power motor, or from line shaft. Screens up to eighteen ft. in length have been built and are said to be operating satisfactorily with the same size motor.

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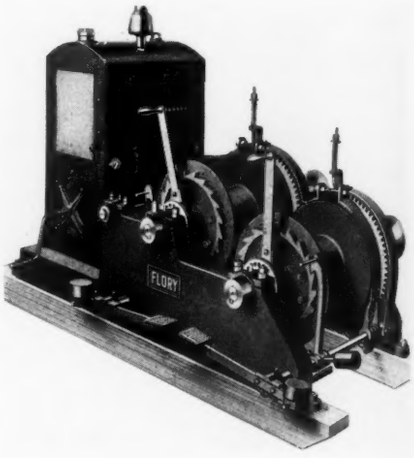
## New Light Duty Hoist

S. FLORY MANUFACTURING CO., Bangor, Penn., have just brought out a new light weight and compact small hoist called the Flory "Cub." It has a rated capacity of 1500 lbs. single line pull at a down speed of 125 feet per minute.

The new hoist is made with a cast iron base upon which is mounted a two-cylinder 8-10 hp. gasoline motor power unit, radiator cooled, and which drives the gearing through sprockets and chains. The complete outfit, mounted on skids, is made in the two-drive type pictured herewith and in a single-drive type. The weight of the two-drive outfit is given as 1700 lbs. and that of the single-drive design as 1250 lbs.




***Double-drum type of new light-weight hoist***

The hoist is equipped with winch head and ratchet and pawl. The brake is two piece, band type, lined with non-burning material, the band suspended from the bracket with a spring so as to keep it free when not in use. Molded asbestos cone is standard equipment on the friction clutch. A new bulletin, No. 1524, describing the new hoist will soon be available.

## New Cable Draglines

TWO different types of cable draglines are offered by the Schofield-Burkett Construction Co., Macon, Ga. The type "A" machine for loading material is made in five sizes, ranging from ¾- to 4-cu. yd. bucket capacity with manufacturers rated delivery capacities of from 150 to 1000 cu. yd. per day. The type "B" or stripping equipment contains four different sizes up to 3-cu. yd. bucket capacity. The excavator is designed for operations in sand and gravel pits, shell marl or lime rock quarries or wherever earthly material is to be gathered as in piling overburden. A combination machine which permits one type to be changed to the other is also furnished, if desired. This combination is made possible by a recently designed steel incline or chute for loading into cars, trucks or hopper, the manufacturers say.

*New cable dragline with patented snubbing device*

One of the features of the new draglines is a new patented snubbing device, through which it is said the operator can keep the bank or pit clear of ditches or ridges. One setting, it is claimed, permits a large area of ground to be covered and thus eliminates the use of auxiliary hauling equipment, though the distance from the operation to the plant hoppers or bunkers is remote. Only one man is needed to operate the type "A" and two men on the type "B" machine, the makers say.

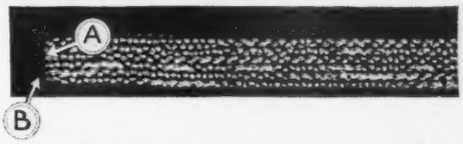
The hoist of the machine is a triple-drum, gasoline, steam or electric power unit. The sheaves are of steel, 1¼-in. deep and fitted with grease cups and bronze bushings. The scraper is made of plow steel with reinforcing plate on the bottom. Mast pole for type "B" is 50 ft. (standard length) and made of 12-in. channels, latticed together. The incline for type "A" is of riveted steel plates, the height and length depending on the height of the receiving car, truck or hopper.

## New Trench Hoe Useful in Stripping Overburden

A NEW type of pull shovel or trench hoe has been put on the market by the Thew Shovel Co., Lorain, Ohio. The new machine is called a "back digger" and shovels of this type have been used at different rock products operations for stripping overburden.

The principal operation feature, the manufacturers say, is in the control of the dipper, which, it is claimed, can be tilted by the operator to any angle desired, at any stage of the digging or dumping operation, and held in position or changed by the operator at will. The dipper tooth angle can also be maintained at any position of the digging arm, it is claimed. Sticky material clinging to the dipper can be dislodged by the operator shaking the bucket.

The new equipment is said to be designed to attach to any Lorain-75 or Lorain-60 shovel now in the field.




*Foldless construction on new type of conveyor belt*

## New Type of Conveyor Belt

THE B. F. Goodrich Rubber Co., Akron, Ohio, has recently adopted a new type of construction for all its brands of rubber-covered conveyor and elevator belts. This new feature is being described commercially as the "Highflex" construction and consists essentially in the elimination of all folds in laying up the fabric, each ply being a separate unit insulated from adjoining piles.

This new construction was developed to meet the needs of modern conveying systems, in which higher speeds and longer center distances are rapidly becoming common practice. The manufacturers claim an increase in flexibility through the foldless construction which improves the pulley contact to a marked degree and better tension distribution.

Another advantage pointed out by the makers of this new construction is the new Goodrich bonded edge, by which a heavy edge cushion, continuous with the top cover, is securely united to the edges of the fabric. This feature is said to prevent the edge from tearing loose in strips in case the edge of the belt is gouged by an obstruction.

In one installation of an 8-ply Highflex construction belt more than 2000 ft. long, the manufacturers say it was found possible to operate the conveyor fully loaded without any tension whatsoever on the return side.

*New pull shovel for stripping operations*

# News of All the Industry

## Incorporations

**New York Consolidated Slate Co., Inc.**, chartered in Delaware, to deal in slate of all kinds.

**Saybrook Concrete Co.**, Old Saybrook, Conn., $25,000. Frank Appleby of Old Saybrook, and others.

**Owsley Sand and Gravel Co.**, Houston, Tex. $50,000. H. F. Owsley, D. S. Harston and Elton M. Hyder.

**Lewis County Concrete Products Co.**, Centralia, Wash., $20,000. E. B. Ballinger, W. F. Paddock and R. G. Denney.

**Carolina Mica Corp.**, Wilmington, Del., $250,000.

**Pinkerton Sand Co.**, La Porte county, Ind., has filed certificate of final dissolution.

**Foundry Sand and Products Co.**, New Albany, Ind., $3,000. To deal in sand and gravel. Michael E. Maloney, Wm. C. Broadfuehrer and Claude O. Davis.

**M. F. Kaufman Concrete Co.**, Louisville, Ky., $25,000. Marshall F. Kaufman, 9 Kenworth Rd., Louisville; Louis Kaufman and Blanche A. Kaufman.

**Duo Sand and Rock Co.**, Jacksonville, Fla., to deal in sand and by-products. 50 shares, par value none. M. T. Crabtree, Charles Giller, N. B. Giller, board of directors.

**South Florida Rock Corp.**, Miami, Fla., $10,000 divided into 100 shares, each of $100 par value. Deal in lime rock, stone and minerals. E. G. Moore, S. K. Hicks, 60 W. Flagler St., and E. E. Saar, board of directors.

**Banner Rock Products Co.**, Alexandria, Ind. Increasing capital stock from $200,000 common and $400,000 preferred to $250,000 common and $400,000 preferred; also changing par value of common stock from $100 a share to $5 a share.

## Quarries

**Falls City Quarry Co.**, on the River road near Louisville, Ky., is filling a contract for rock for 9½ miles of road between the Jefferson county line and La Grange.

**Chipley, Fla.** T. H. Thompson and associates of Jacksonville, Fla., have purchased a site on the Alabama & West Florida railroad near Chipley, Fla., where they plan to erect a new limestone crushing plant.

**Sparta Crushed Stone Co.**, Sparta, Ga., is working full time to fill orders for crushed granite for use in street and road paving. L. L. Stewart, manager of the company, expects to run the crusher plant on extra time to handle the increasing demand for crushed stone.

**Somerset Stone Crushing Co.**, Bernardsville, N. J., has sold its holdings on Mine Brook road to the Hoffman Construction Co. of Blazure's Corner, who will operate the plant. This plant had been operating for thirty years or more up until about four years ago, when operations ceased.

**Montreal, Que.** Charged with failing to make sales tax returns to the Canadian government, the city of Montreal was called into court in connection with the exploitation of a quarry in Maisonneuve Park. The city maintains that it is not liable for this tax. A fine on conviction of this charge ranges from $50 to $1000.

## Sand and Gravel

**Brookville Gravel Co.**, Brookville, Ohio, has installed a large new revolving screen and gravel washing equipment at its plant near Brookville.

**Coast Rock and Gravel Co.** have installed two new 20-ton gasoline locomotives, to replace their steam engines, and a new steam 25-ton crane at their Oroville, Calif., plant.

**Salem Hill Gravel and Sand Co.**, Beach Haven, Penn., has approved plans for the complete electrification of its plant. Additional equipment will also be installed at the plant.

**Moraine Sand Co.**, located on the Springboro pike, Dayton, Ohio, has been sold to a new company which will be known as the Moraine Sand and Asphalt Co. The officers of the new company are Clifton Hoolihan, president; D. E. Hayes, vice president, and Wayne F. Lee, secretary.

**Service Bros.**, Waterford, Calif., is planning to abandon operations at their present pit and start opening a new deposit which is adjacent to the present plant. The old plant will be kept in use as a sand plant, as during the high water in the last few seasons an abundance of sand has been washed into the pit.

**Hamilton, Ohio.** Nellie A. Grabel, who owns 8 acres of land in Wayne township, part of which fronts on the Hamilton-Richmond pike, has brought suit to restrain the Eldorado Paving Co. and H. S. Coulter from digging gravel on her land, and asking judgment for $250 for gravel already taken, claiming that removal of the gravel will lessen the value of her land. A temporary restraining order was issued.

## Cement

**Lawrence Portland Cement Co.**, Northampton, Penn., will make improvements in its mill, including the installation of a new dust collecting system and other equipment, to cost close to $40,000.

**New Bern, N. C.** It is reported in the *Raleigh* (N. C.) *News* that representatives of a large portland cement company have visited New Bern recently and are contemplating the location of a plant there.

**Northwestern Portland Cement Co.**, Portland, Ore., has completed the buildings of its new plant at Grotto, Wash., and is now installing machinery. The plant, which will have a daily capacity of 2000 tons, is expected to be in operation early in 1928.

**Monolith Midwest Portland Cement Co.**, Los Angeles, Calif., announce the appointment of Carol A. Low, formerly director of sales, to the position of assistant general manager. Mr. Low has been identified with the selling of cement since 1908. Thomas R. Larson, who has been traffic manager and assistant sales manager, takes Mr. Low's place as director of sales. Mr. Larson has spent almost his entire business career in the cement field and entered the service of the Monolith Portland Cement Co. when it first began operations.

**Pennsylvania-Dixie Cement Corp.** entertained 51 members of the Chattanooga Engineers Club at luncheon at the Dixie Inn at Richard City, Tenn., on Tuesday, August 30. W. H. Klein, general manager of the southern plants, gave the club a brief outline of the manufacture of portland cement. After inspecting the plant and quarries of the company, escorted by Mr. Klein, Mr. Legg, superintendent, and Mr. Hardy, engineer, members of the club were taken to the Dixie Portland Memorial School building, where the engineers were shown how portland cement has taken its place in works of art.

## Cement Products

**Madko Concrete Products Co.**, Madison, Wis., has been granted a permit to erect a concrete block factory on Fair Oaks Ave., at a cost of $3000.

**Atlanta Cinder Block and Tile Co., Inc.**, Atlanta, Ga., K. W. Brittain and E. M. Willingham of 344 Ponce de Leon Ave., Atlanta, owners, plan to erect a modern factory.

**Massey Concrete Products Corp.**, Minneapolis, Minn., will rebuild the portion of its plant destroyed by fire September 27. The loss from the fire was reported to be in excess of $150,000, including equipment.

**Semloh Contracting Co., Inc.**, Brooklyn, N. Y., have purchased property in Brooklyn on which it is planned to erect a modern cement block manufacturing plant.

**American Art Marble and Granite Co.**, Tampa, Fla., has leased a factory for the manufacture of artificial marble and granite, and will install immediately mixers, sand washers and dryers.

**Alabama Concrete Pipe Co.**, Birmingham, Ala., has started shipments from its new plant placed in operation the latter part of August. Orders have been received for a number of new highway projects in various sections of the state.

**Covington, Ga.** L. V. Thayer of New York City, Charles Gailey of Conyers, Ga., and A. B. Fowler and Joseph Kopp of Atlanta, Ga., were here recently to investigate the possibilities for manufacturing cement brick in Newton county. According to reports, immediate steps will be taken to erect a plant in Newton county with a capacity of 100,000 brick per day to supply the territory adjacent to Atlanta and Macon.

## Lime

**Black Marble and Lime Co.**, Enterprise, Ore., held open house on Sunday, September 18, for visitors to inspect the progress of the construction work on the company's new plant near Enterprise. Concrete foundations and walls for the plant buildings and bins have nearly been completed.

## Gypsum

**United States Gypsum Co.**, Chicago, Ill., is said to be planning the construction of a new gypsum products plant at Midland, Calif., to serve the Pacific coast markets. It is reported that the new plant will cost upward of $250,000 with equipment.

## Miscellaneous Rock Products

**Building Materials Corp.**, New York, N. Y., dealing in potash and by-products, is in the hands of receivers, according to local newspaper reports. This action followed an equity suit brought against the company by Wm. Davis and Henry Seibricht. The company some time ago took over the Raritan Limestone Co. and the Eastern Limestone Co. and has outstanding $2,000,000 of debenture bonds on which no interest has been paid in over a year.

**Malehurst Barytes Co.** has taken over the management of the old-established business of the Devonshire Baryte Co., Ltd., of Exeter and Bridford, England. It is proposed to re-equip the mine and develop its resources. The continued supply of the grades of barytes for which this company has been well known for the past 50 years will thus be assured and improved grades of Devonshire barytes will be placed on the market at an early date.

## Talc

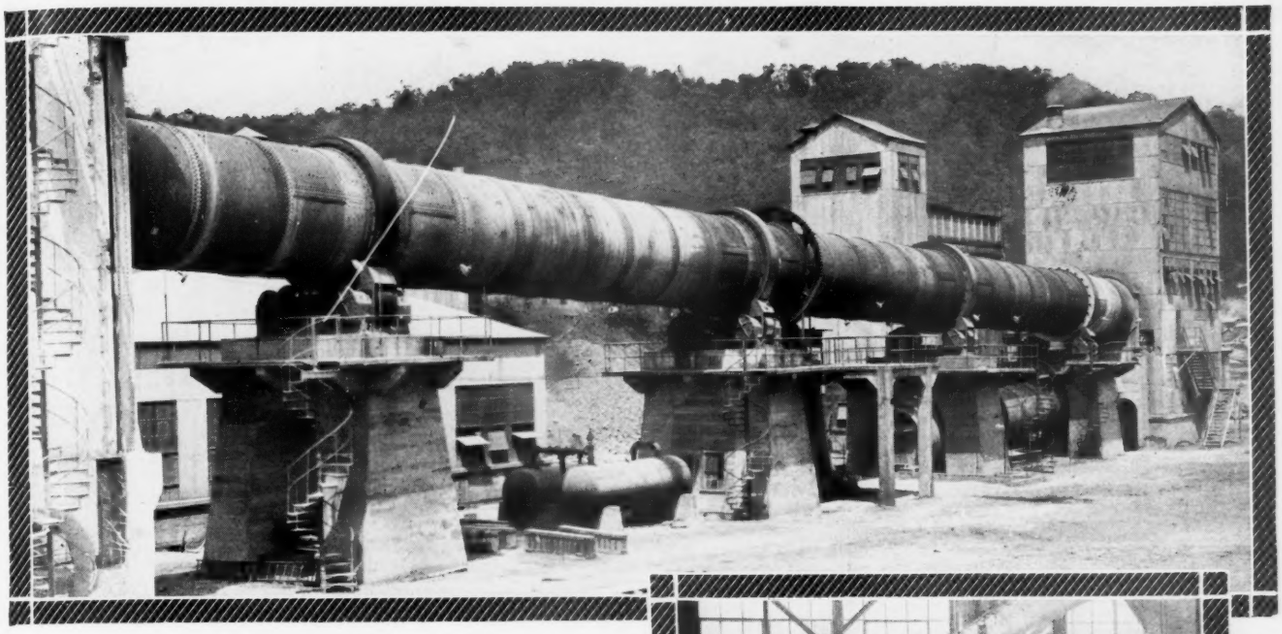
**Ganim Mining Co.** Fire of unknown origin destroyed the works at the Ganim mine, two miles west of Whisky Town, near Redding, Calif., on the afternoon of September 26. The loss is estimated at $10,000.

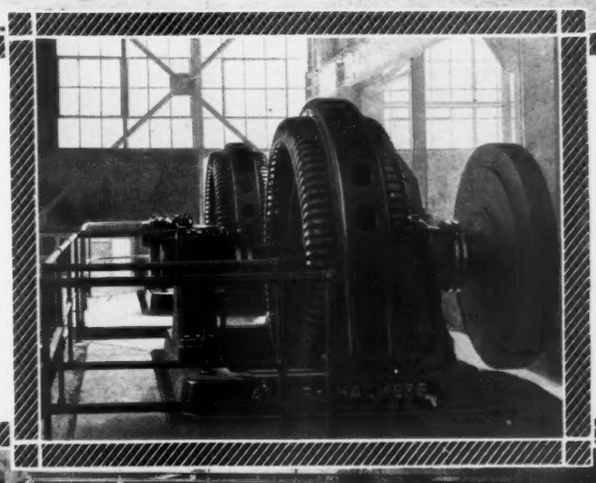
## Personals

**H. G. Meether** of Miami, Fla., has been appointed the representative in southeastern Florida for the Florida Portland Cement Co. of Tampa.

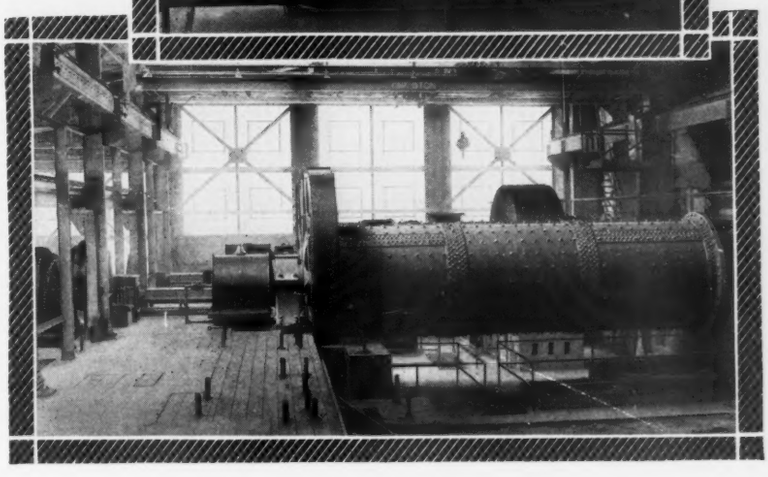
**C. B. Kessinger,** Vincennes, Ind., has been named representative for the state of Indiana for the Osage Gravel Co., an Illinois corporation.

**Walter Sennhauser,** formerly mechanical engineer for Sulzer Brothers, Ltd., Winterthur, Switzerland, arrived at New York, September 26, to assume his new duties as chief engineer of the Dry Quenching Equipment Corp. This company is a new subsidiary of International Combustion





# Another Modern Plant Equipped With Allis-Chalmers Cement Mill Machinery



Here is another new installation using Allis-Chalmers machinery. This modern plant of the West Penn Cement Company at West Winfield, Pa., has as its major equipment—

**One 11′ 6″ x 250′ four support kiln with two roller carrying mechanism of self lubricating type provided for water cooling and direct connected gear drive train with cut steel gears.**

**One 9′ x 90′ cooler.**

**Two 8′ x 30′ Raw Grinding Compeb Mills.**

**One 8′ x 30′ finish grinding compeb mill.**

**Three 800 H.P. Synchronous Motors, as well as the other motors in the plant are of Allis-Chalmers make.**

Allis-Chalmers equipment is used in most modern mills. Allis-Chalmers manufacturing facilities and engineering service are known and appreciated by these plants.

# ALLIS-CHALMERS

MILWAUKEE, WIS. U. S. A.

*When writing advertisers, please mention ROCK PRODUCTS*

Engineering Corp. and was organized to exploit the recently acquired American rights to patents covering the Sulzer system for dry quenching coke.

**Syd. J. McAuliffe**, managing director of Gilbert McAuliffe Pty., Ltd., engineers and contractors for lime, gypsum, cement and quarry plants, Melbourne, Australia, was a recent visitor of "Rock Products." He is in the United States in the interests of the lime industry in Australia.

**Dr. William L. Ellerbeck**, president of the Nephi Plaster and Manufacturing Co. and vice president of the Utah Lime and Stone Co., Salt Lake City, has recently spent some time in the Pacific Northwest, and while in Portland he delivered three lectures to groups of contractors on the uses of stucco.

**Charles C. Phelps**, combustion engineer, announces the removal of his office from Paterson, N. J., to Room 528, 30 Church St., New York City, N. Y., where he will act as representative for the following companies: Power Plant Equipment Co., Uehling Instrument Co., A. W. Cash Co., Williams Gauge Co., and Hill Clutch Machine and Foundry Co.

**Robert G. Rauscher**, formerly connected with the auditing firm of Haskins & Sells, has been appointed comptroller for the Charles Warner Co. Mr. Rauscher will have full charge of all accounting policies and practices not only in the Charles Warner Co. and the West Jersey Sand and Supply Corp., but also for the American Lime and Stone Co., and will establish headquarters in the main offices of the company at Wilmington, Del.

**William Andrews**, consulting engineer of the Valley Forge Cement Co., West Conshohocken, Penn., addressed the Norristown Lions at a luncheon held at the Plymouth Country Club, Norristown, Penn., on September 28. Mr. Andrews explained the advantages of cement manufacture in Montgomery county, the chief reasons given being the proximity to metropolitan markets and that the limestone in the Chester valley is most ideally adapted to use for this purpose. Mr. Andrews declared the vicinity of Norristown is a strategic point for the location of a cement plant.

## Obituaries

**Nels J. Peterson**, president of the Ideal Cement Stone Co., Omaha, Neb., died at his home in Omaha on October 6.

**Daniel L. Shideler**, owner of a gravel plant near Huntington, Ind., died recently at his home. Mr. Shideler, who was 72 years old, was in good health until the day of his sudden death. He is survived by his widow and two children.

**Henry B. Shive**, quarryman, of Salisbury, N. C., died recently from injuries received while blasting at his quarry. Mr. Shive was 40 years old and had worked his quarry near the Shuping Mill, ten miles east of Salisbury, for years. His death was the fourth caused by granite quarry explosions in North Carolina on the same day.

## Manufacturers

**American Engineering Co.**, Philadelphia, Penn., announces the appointment of George L. Drake as agency sales supervisor for its Lo-Hed hoist division.

**Falk Corporation**, Milwaukee, Wis., announce the appointment of E. R. Harris, 1123 Metropolitan Life Bldg., Minneapolis, Minn., as representative for the state of Minnesota and also Douglas county, Wis.

**Mundy Sales Corp.**, New York, N. Y., has appointed the Milburn Machinery Co., Columbus, Ohio, as exclusive agents for Mundy products, including the new patent three-speed hoist, for central Ohio.

**Hill Clutch Machine and Foundry Co.**, Cleveland, Ohio, announce the opening of their metropolitan district office at Room 528, 30 Church St., New York City, with Charles C. Phelps, sales engineer, in charge.

**Pennsylvania Pump and Compressor Co.**, Easton, Penn., announces the appointment of E. P. Meixsell as manager of their New York office at 136 Liberty St. Mr. Meixsell was formerly assistant sales manager at the Easton plant.

**Hyatt Roller Bearings Co.'s** products came in for a good share of attention at the recent Machine Tool Show at Cleveland. Nearly 50 users of Hyatt roller bearings in their machine tools were listed in a "Roll of Honor" which comprised the background of the company's display at the show. Cutouts of other Hyatt-equipped machines provided interest.

**Kendallville, Ind.** The plant of Raber and Lang Manufacturing Co., which has been manufacturing cement mixing machinery for the past 20 years, has been sold to H. J. Crosvenor and H. L. Grosvenor of Fort Wayne, Ind. The purchase was made from the receiver of the company for $27,000. The new owners will continue the same line.

**Marsh-Capron Co.**, Milwaukee, Wis., announce the opening of a new office at 1601 Chestnut St., Philadelphia, Penn., and a new warehouse at Primos, Penn., with a full line of Marsh-Capron concrete, plaster and mortar mixers and repair parts. W. B. Patterson is in charge as district manager of easten Pennsylvania, southern New Jersey and eastern Delaware.

**Combustion Engineering Corp.**, New York City, N. Y., has appointed Walter Springe as district manager in the Kansas City and St. Louis territories. Mr. Springe has represented the Heine Boiler Co. in these territories for the past 25 years. The company also announce the appointment of R. J. Robinson as branch manager, under Mr. Springe, at St. Louis.

**McGann Manufacturing Co., Inc.**, York, Penn., has made contracts for a complete Schulthess hydrate plant to be shipped to the Novella Cement Co., Guatemala City, Central America, and a complete Schulthess hydrate plant to be built for the Universal Gypsum and Lime Co. of Chicago for their high calcium lime operations at Oglesby, Tex.

**Harbison-Walker Refractories Co.**, Pittsburgh, Penn., has acquired the United States rights to a new German method of producing refractory brick. The first unit is now being installed in the Harbison company's East Chicago plant and will be followed by further installations at the other plants operated in western Pennsylvania and Birmingham, Ala.

The new process is continuous and involves the use of a 500-ft. car tunnel kiln of the Koppers type, producer gas fired, using the regenerative principle. The daily capacity of the kiln is given at about 100 tons. Control of operation is through pyrometers, draft and pressure gages. Waste heat from the kiln will be used in pre-drying the green brick and heating the plant.

**General Electric Co.**, Schenectady, N. Y., announces the following changes and appointments: **W. M. Stearns** has been transferred from the central station department of the company to the general commercial department, and has been appointed manager of special contracts. He will also actan as an assistant to vice-president J. C. Barry. **A. D. Cameron** has been appointed manager of the street lighting and supply division of the central station department and there has been set up in the same department a holding company division with W. P. White as manager. **F. H. Winkley** has been appointed manager of sales of the street lighting section of the street lighting and supply division, succeeding Mr. Cameron.

## Trade Literature

*NOTICE—Any publication mentioned under this heading will be sent free unless otherwise noted, to readers, on request to the firm issuing the publication. When writing for any of the items kindly mention* ROCK PRODUCTS.

**Wire Rope.** Revised edition of "Practical Information on the Use and Care of Wire Rope." A. LESCHEN & SONS ROPE CO., St. Louis, Mo.

**Westinghouse Motors.** Illustrated bulletin, "A Standard Motor for Every Need." WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., East Pittsburgh, Penn.

**Dry Quenching Equipment.** Publication **S-1** on the Sulzer system for dry quenching of coke. INTERNATIONAL COMBUSTION ENGINEERING CORP., New York.

**Owen Buckets.** Two new bulletins announcing types M and K clamshell buckets, with detailed description and illustrations. OWEN BUCKET CO., 6000 Breakwater Ave., Cleveland, Ohio.

**Nickel Cast Iron.** Bulletin No. **202**, "The Economic Value of Nickel in Cast Iron," and No. **204**, "Effect of Nickel on Machinability of Cast Iron." INTERNATIONAL NICKEL CO., New York.

**Kiln Mill.** Bulletin on air-drying pulverizer for use in preparing ground limestone and gypsum. Report of test run on high calcium limestone. RAYMOND BROS. IMPACT PULVERIZER CO., Chicago, Ill.

**G-E Bulletins. GEA-118A** on push button stations for use in control circuits of magnetic controllers; **GEA-817** on battery changing equipment; **GEA-819** on horizontal edgewise instruments, types H-5, H-6 and DH-5.

**Shock Absorbers.** Illustrated bulletin completely describing the Ajax industrial shock absorber and setting forth advantages of the Ajax rubber bumper coupling. AJAX FLEXIBLE COUPLING CO., Westfield, N. Y.

**Bethlehem Pulverizers**, Catalog J illustrating and describing Bethlehem pulverizers for crushing coal, gypsum, dolomite, sand and other rock products. Details of construction, specifications, design data, etc. BETHLEHEM STEEL CO., Bethlehem, Penn.

**Whitcomb Locomotives.** Bulletin No. **2723** covering Class WVAU-6 (6-ton), CKU-7 (7-ton) and CTU-8 (8-ton) 4-wheel, 4-speed, gear-driven gasoline locomotives. Construction details, data on design, illustrations, etc. GEO. D. WHITCOMB CO., Rochelle, Ill.

**Gears and Speed Reducers.** Catalog No. **133**, giving detailed description of the various features of James generated continuous-tooth herringbone gears and speed reducers, together with illustrations of types and installations. D. O. JAMES MANUFACTURING CO., Chicago, Ill.

**Industrial Rail Equipment.** Bulletin No. **130** listing new and relaying steel rails, locomotives, cars—passenger and freight, railway and track equipment of all kinds, used machinery, hoists—steam and electric, air compressors, boilers 40 hp. to 750 hp., crushers and generator sets and other kindred equipment. HYMAN MICHAELS CO., Chicago, Ill.

**Turbines.** Bulletin **3907-C** describing turbines for mechanical drive in capacities of 5 to 750 brake-horsepower. Descriptive information, illustrations and data on use in driving circulating pumps, boiler feed pumps, blowers and other rotary apparatus. WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., East Pittsburgh, Penn.

## Large Ganister Mine Opened in England

DEVELOPMENT of a new and valuable seam of ganister at Wharncliffe Crags, near Sheffield, England, has been recently reported. J. Grayson Lowood and Co., of England, are working the mine, but up to the present time they have only removed the outcropping. The work of driving underground has now been commenced and it is expected that the company will have the mine operating on a large scale within a few months. The seam is composed of what is known as Halifax hard bed ganister, and it has been found to average nearly 3 ft. in thickness. The working of the outcropping has already reached more than a mile in extent, and it is expected that when the mine is fully opened it will be the largest in the district. The entire output will be used for boiler purposes and for refractories in brick kilns.

## Obtains Control of British Timken

THE Timken Roller Bearing Co., Canton, Ohio, and M. B. U. Dewar of London, England, have, together, purchased from Vickers, Limited, all of the capital stock of British Timken, Limited. This purchase gives Timken complete control, throughout the world, of the manufacture and sale of Timken bearings.

Mr. Dewar, who now assumes active management of British Timken affairs, was until recently managing director of the Metropolitan Carriage, Wagon & Finance Co., Limited, of Birmingham, England, and he was also a member of the industrial management board of Vickers, Limited.

The Birmingham plant of British Timken, Limited, is being enlarged, and large quantities of new machinery and equipment have been installed. Officials of British Timken, Limited, are now at the Canton, Ohio, works making final arrangements for the immediate establishment of factories in France and Germany.